Fishery Management Report No. 91-3

Annual Management Report for Sport Fisheries in the Arctic-Yukon-Kuskokwim Region, 1989

by

William D. Arvey

December 1991

Alaska Department of Fish and Game

Division of Sport Fish

FISHERIES MANAGEMENT REPORT NO. 91-3

ANNUAL MANAGEMENT REPORT FOR SPORT FISHERIES IN THE ARCTIC-YUKON-KUSKOKWIM REGION, 1989[1]

By

William D. Arvey

Alaska Department of Fish and Game
Division of Sport Fish
Anchorage, Alaska

December 1991

[1] Some of the data included in this report were collected under various jobs of project F-10-5 of the Federal Aid in Fish Restoration Act (16 U.S.C. 777-777K).

The Fishery Management Reports series was established in 1989 for the publication of an overview of Division of Sport Fish management activities or management goals in a specific geographic area. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Distribution is to state and local publication distribution centers, libraries and individuals and, on request, to other libraries, agencies, and individuals. This publication has undergone editorial and peer review.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF APPENDICES

ABSTRACT

This report presents a compilation of information on the recreational fisheries of northern, northwestern, western, and interior Alaska, an area referred to as the Arctic-Yukon-Kuskokwim Region. Important species to the sport fisheries in this region are identified, zoogeographic distribution of species is discussed, as is stock status and sport fishing harvest during calendar year 1989. Regulatory actions affecting the regional sport fishery in 1989 are described along with other management, research, and enhancement activities. Climatic factors of importance to area fisheries are summarized, and federal land status within the region is described.

KEY WORDS: Arctic, Yukon, Kuskokwim, Tanana River, sport fishery, fishery management, recreation, harvest, effort, abundance, regulations.

PREFACE

This is the fourth Annual Management Report for sport fisheries in the Arctic-Yukon-Kuskokwim Region (AYK Region). Statistics pertinent to recreational fisheries in the AYK Region are presented, Alaska Department of Fish and Game (ADFG) research and reporting activities are described, stock status information is presented, regulatory changes in 1989 are documented, and other natural and man-influenced factors that may affect fish survival and production during the reporting period are briefly summarized. In addition, long term trends in abundance and/or exploitation are described. Arvey et al.(1990, 1991), and Arvey and Parker (1991) present similar information for the years 1986, 1987, and 1988. The reader is advised to consult other cited regional reports for specific project information, or, for more abbreviated fisheries summaries, the reader should consult regional reports to the Alaska Board of Fisheries. A brief summary of reports completed by regional staff during the reporting year, along with complete citations is included in this report under the section entitled "Synopses of Published Reports".

INTRODUCTION

The AYK Region encompasses the majority of the landmass of the state of Alaska (Figure 1). Within the region are included some 1,061,000 km^2, the state's largest river systems (Yukon, Kuskokwim, Colville, and Noatak), thousands of lakes, and thousands of miles of coastline and streams. It essentially includes all waters between Cape Newenham in the southwest, (excluding Kuskokwim Bay and the lower Kuskokwim River), the Alaska Range in the south, the Arctic Ocean in the north, and the Canadian border in the east (Figure 1). The region as a whole is very sparsely populated, with the exception of population centers located in the Tanana River valley. Fairbanks (population about 27,000) is the largest of these communities. The Fairbanks North Star Borough Census Area contains about 72,000 people. Other population centers in the region include the Yukon-Koyukuk Census Area with 9,100 people, Nome Census Area with 7,800 people, Southeast Fairbanks Census Area with 6,900 people, Northwest Arctic Borough with 5,800 people, Wade Hampton Census Area with 5,600 people, and the North Slope Borough with 5,500 people (Alaska Department of Labor 1987).

For fishery management, the regional sport fishery program is divided into the Tanana and AYK Areas. The Tanana Area (also called Fairbanks Area) is designated as a separate management area because of the greater impact of its larger human population base upon local fishery resources and the need to conduct more intensive stock specific studies to provide managers with needed biological information.

TANANA AREA DESCRIPTION

The Tanana Area (for harvest reporting purposes in 1989) includes all southern drainages of the Yukon River from its confluence with the Tanana River near Tanana, east to the Canadian border and including the Alaskan portion of the Fortymile and Sixtymile River drainages as well as the entire Tanana River watershed. This area also includes the Alaskan portion of the White River drainage. Although the Tanana Area, for purposes of the statewide harvest report, includes more than just the Tanana River drainage, management responsibilities within the region are limited to the Tanana drainage for the Tanana Area staff.

Geographic and Geologic Setting

The Tanana River basin (Figures 2-6) is an area of approximately 113,900 km^2 (11.4 million ha). The main river is a large glacial stream formed at the confluence of the Chisana and Nebesna rivers near Tok. After flowing downstream in a general northwesterly direction for some 917 km, it meets the Yukon River at Tanana. It is the second largest tributary of the Yukon River; the Porcupine River is slightly larger. The Tanana River receives most of its water volume and its sediment loads from streams draining the glaciers of the Alaska Range and the Wrangell Mountains. All major tributaries flowing into the north side of the Tanana River originate in the Tanana Hills uplands and are clear in both winter and summer. They include the Goodpaster, Salcha, Chena, Chatanika, and Tolovana rivers. Rivers flowing from the Alaska Range

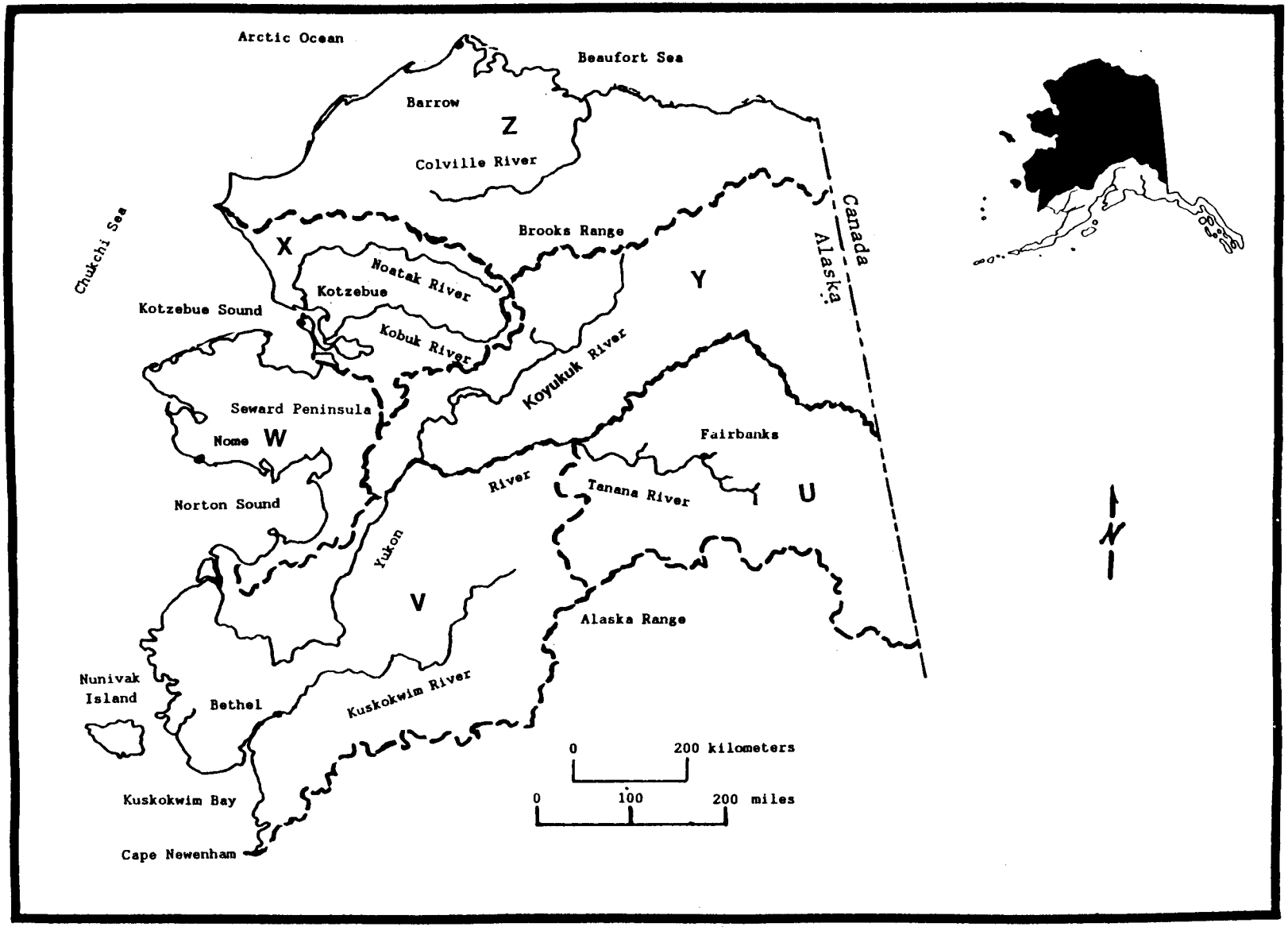


Figure 1. The Arctic Yukon Kuskokwim Region. Dashed lines indicate boundaries between harvest reporting areas U - Z

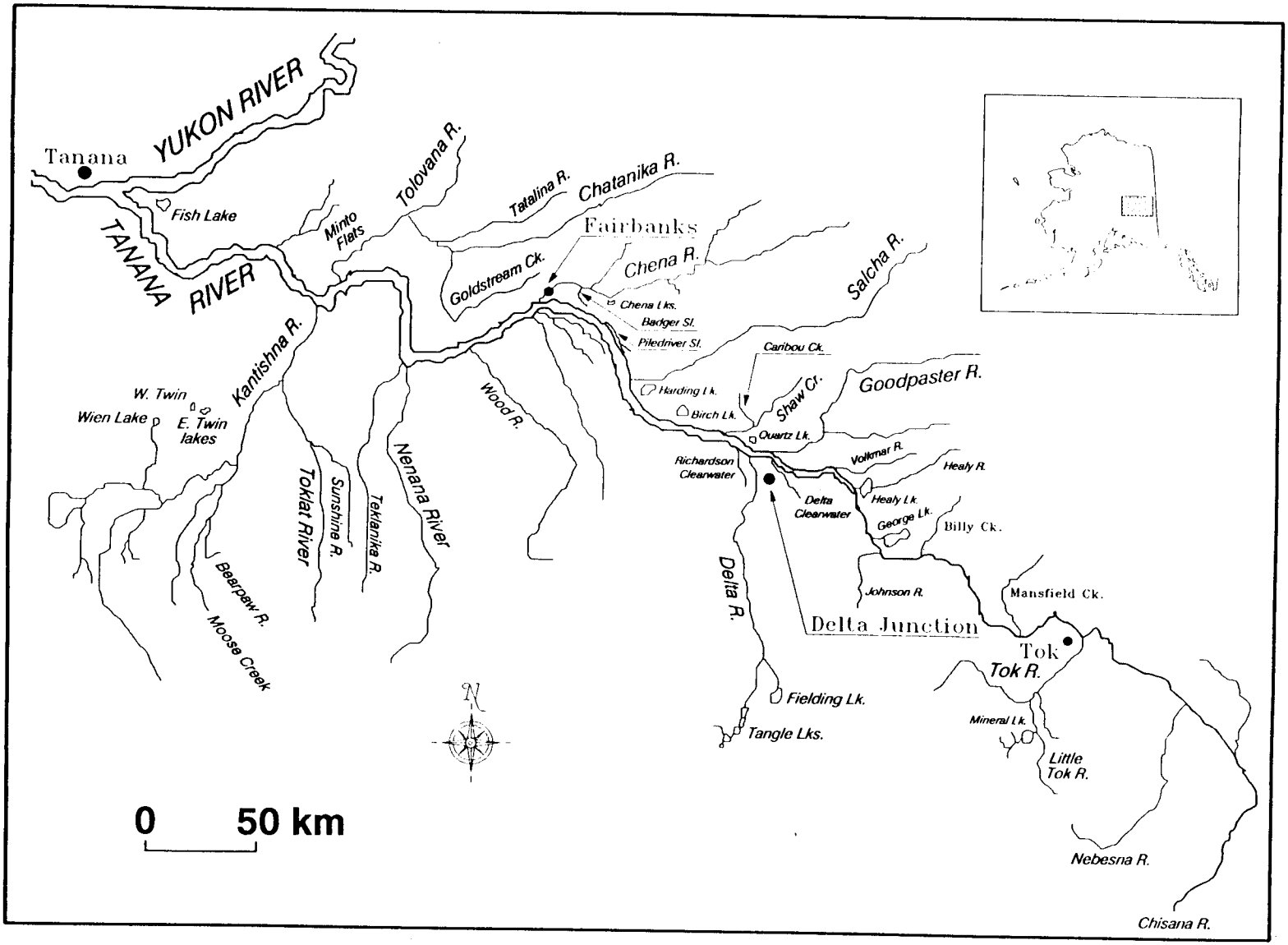


Figure 2. The Tanana River drainage.

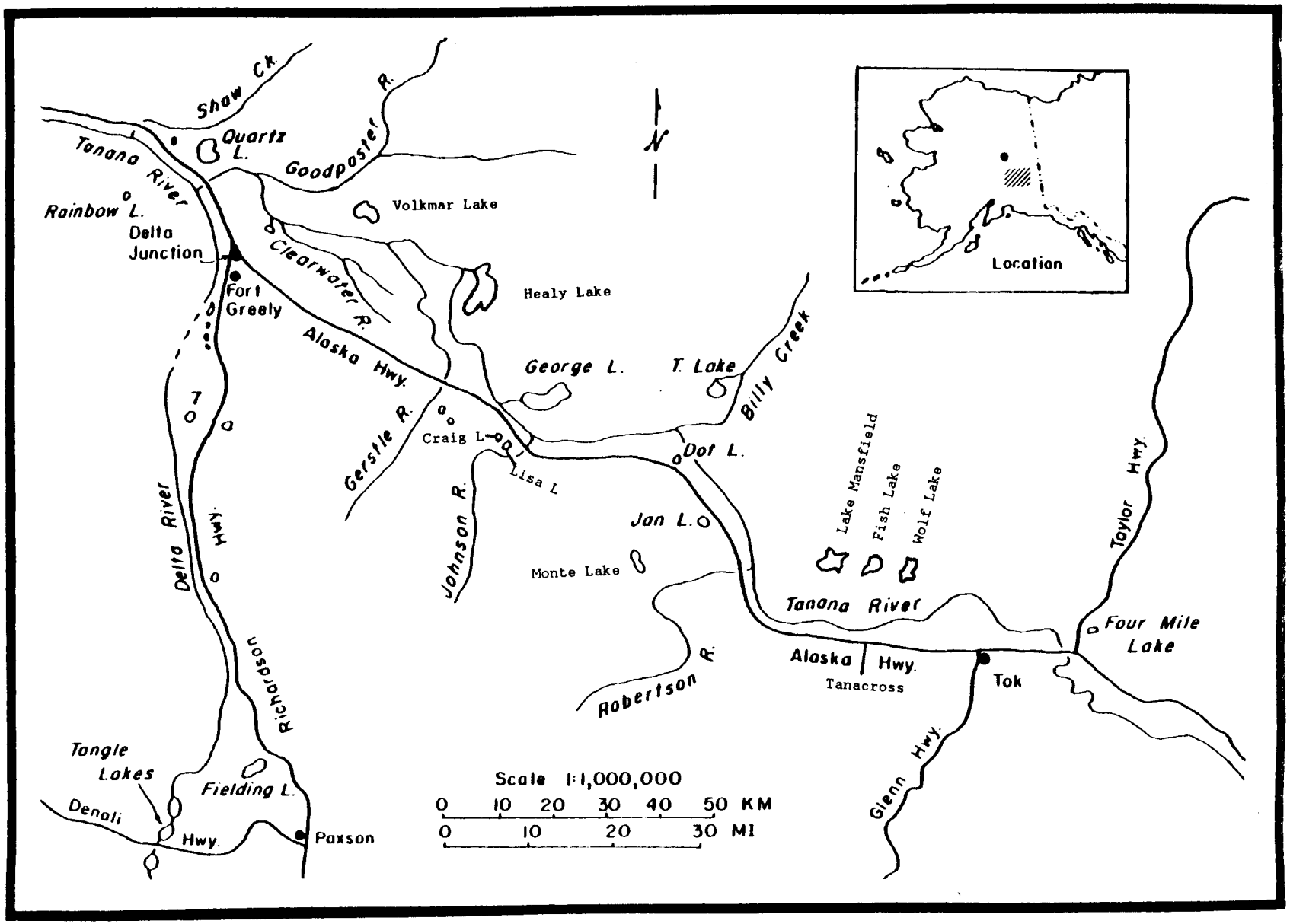


Figure 3. Waters and highways of the middle Tanana River valley.

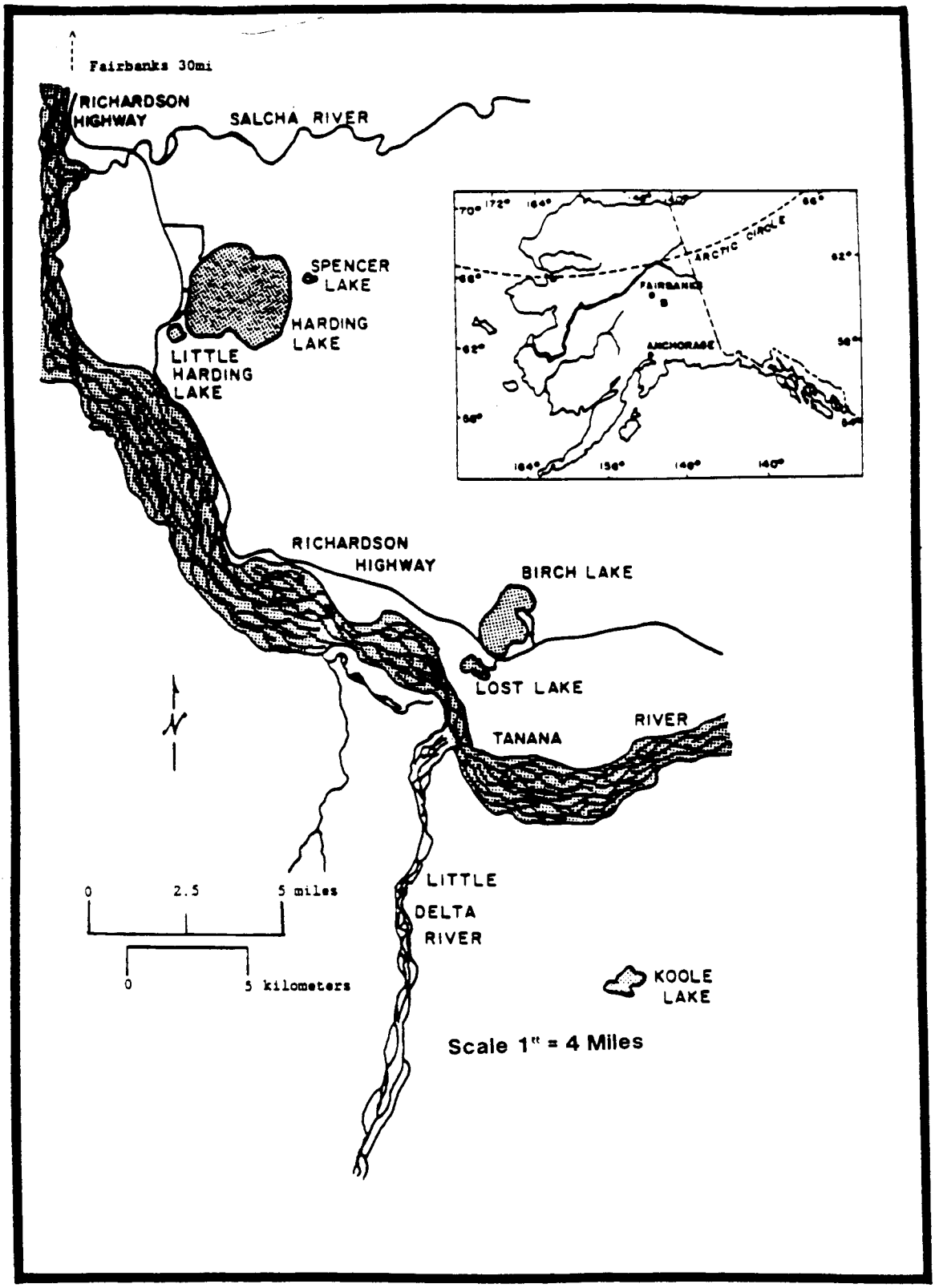


Figure 4. Tanana River waters near Fairbanks.

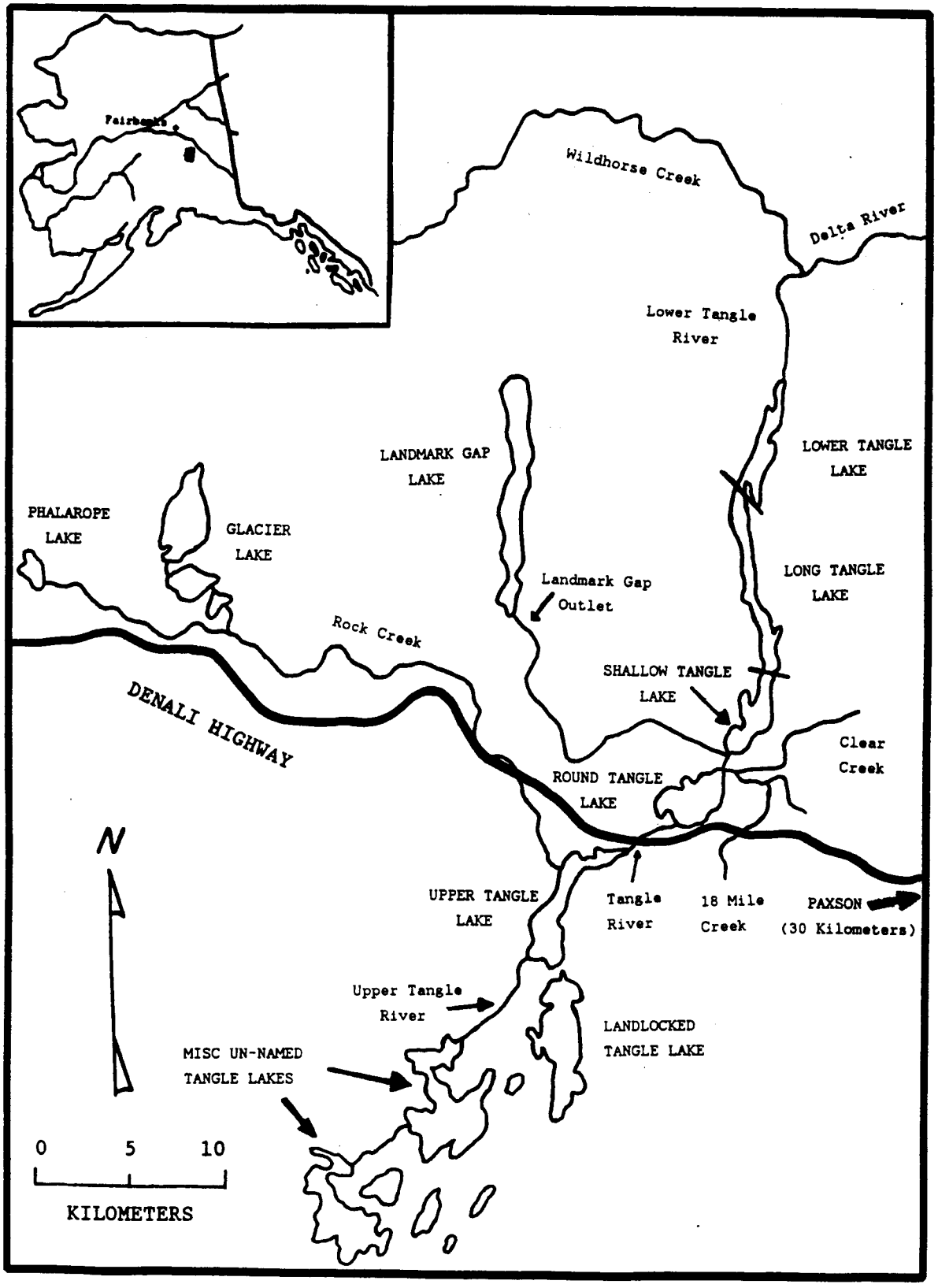


Figure 5. Map of the Tangle Lakes system.

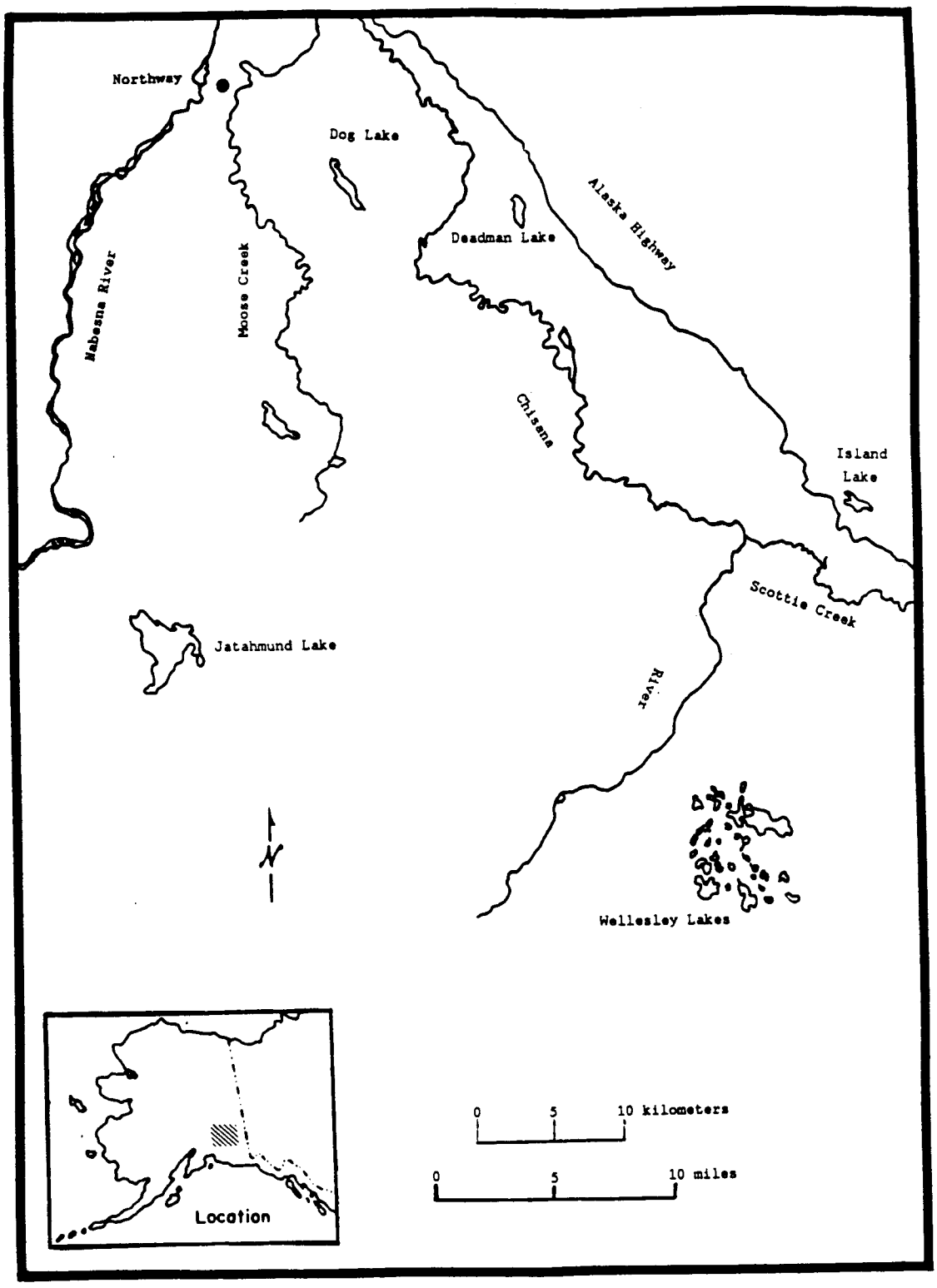


Figure 6. Tributaries of the upper Tanana River.

and the Wrangell Mountains and entering the south side of the Tanana River are of glacial origin. They include the Chisana, Nabesna, Tok, Delta, Nenana, and Kantishna rivers (Figure 2).

The Tanana Area (1989 statewide harvest survey definition) also includes the northern drainage of the White Mountains north of Fairbanks. Included are Birch Creek and its tributaries, and Beaver Creek, both of which empty into the Yukon Flats between Circle City and the Dalton Highway crossing of the Yukon River near Stevens Village (Figure 7). This area is contained within the Yukon Flats National Wildlife Refuge. Upstream from Circle City to the Canadian border the Charley, Seventymile, and Alaska portions of the Fortymile rivers are included in the area. The Yukon-Charley National Wildlife Preserve encompasses much of the Yukon drainage upstream of Circle City to the border, including the streams just listed (Figure 8).

Lake and Stream Resources

Large alluvial aquifers associated with porous floodplain gravels influence fish production by storing water and providing more stable winter stream flows in the upper Tanana River and some of its tributaries from Delta Junction upstream and in the Toklat River, tributary to the Kantishna River. All the large aquifers are located on the south side of the Tanana River and are associated with sub-surface water flows from the north slope of the Alaska Range. The Delta Clearwater and Richardson Clearwater rivers (Figures 2 and 3) are the most important sport fishing streams that originate from these aquifers. The few on-stream lakes (lakes that are directly on a stream tributary to the Tanana River or on the Tanana River itself) present in the Tanana River system are of insufficient volume to sustain stream flow during winter or through dry summers. Glaciers provide some storage of water that can enhance stream flows in dry summers (Selkregg 1976).

Lake development in the Tanana basin is not as extensive as in many other parts of Alaska. Some 20 lakes within the drainage exceed 26 km^2 in surface area (Selkregg 1976). Most of the water bodies within the system do not contain sufficient volume to influence Tanana River flows, but many are important for sport fishing because of wild or stocked species present in the lakes. Primary lakes for sport fishing within the Tanana River drainage are Harding, Birch, Chena, Quartz, Volkmar, George, Fielding, and Tangle lakes (Figures 3 and 4). Volkmar and George lakes do not have roadside access. Chena Lake (Figure 2) in the lower Chena River basin is man-made, resulting from gravel removal to erect flood control structures during the 1970's. Many of the waters listed are shown in Figures 3 and 4, and the lakes of the upper Delta River are shown in Figure 5.

Lakes are generally ice covered by late October and breakup can occur in late June or early July. Typically, ice thickness ranges from 81 to 102 cm in late winter on interior Alaska lakes.

Lakes were formed in various ways. Some (e.g. Harding, Healy, and George lakes) were created by silt from the Tanana River damming streams draining the surrounding hills. Buried ice masses can melt, resulting in lake formation in the sub-glacial soil. Lakes also form when permafrost melts due to vegetative

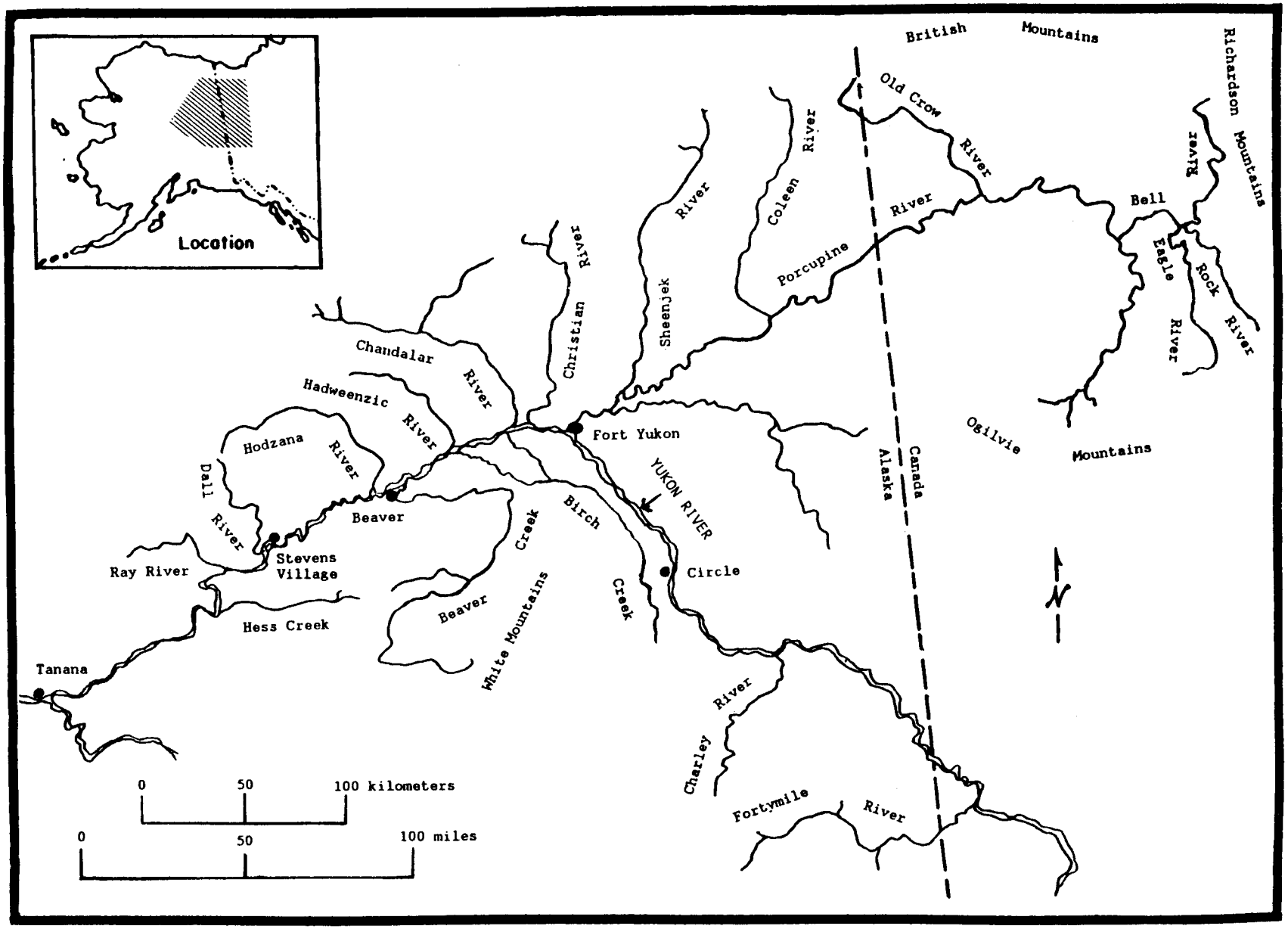


Figure 7. Middle Yukon River and Porcupine River drainages.

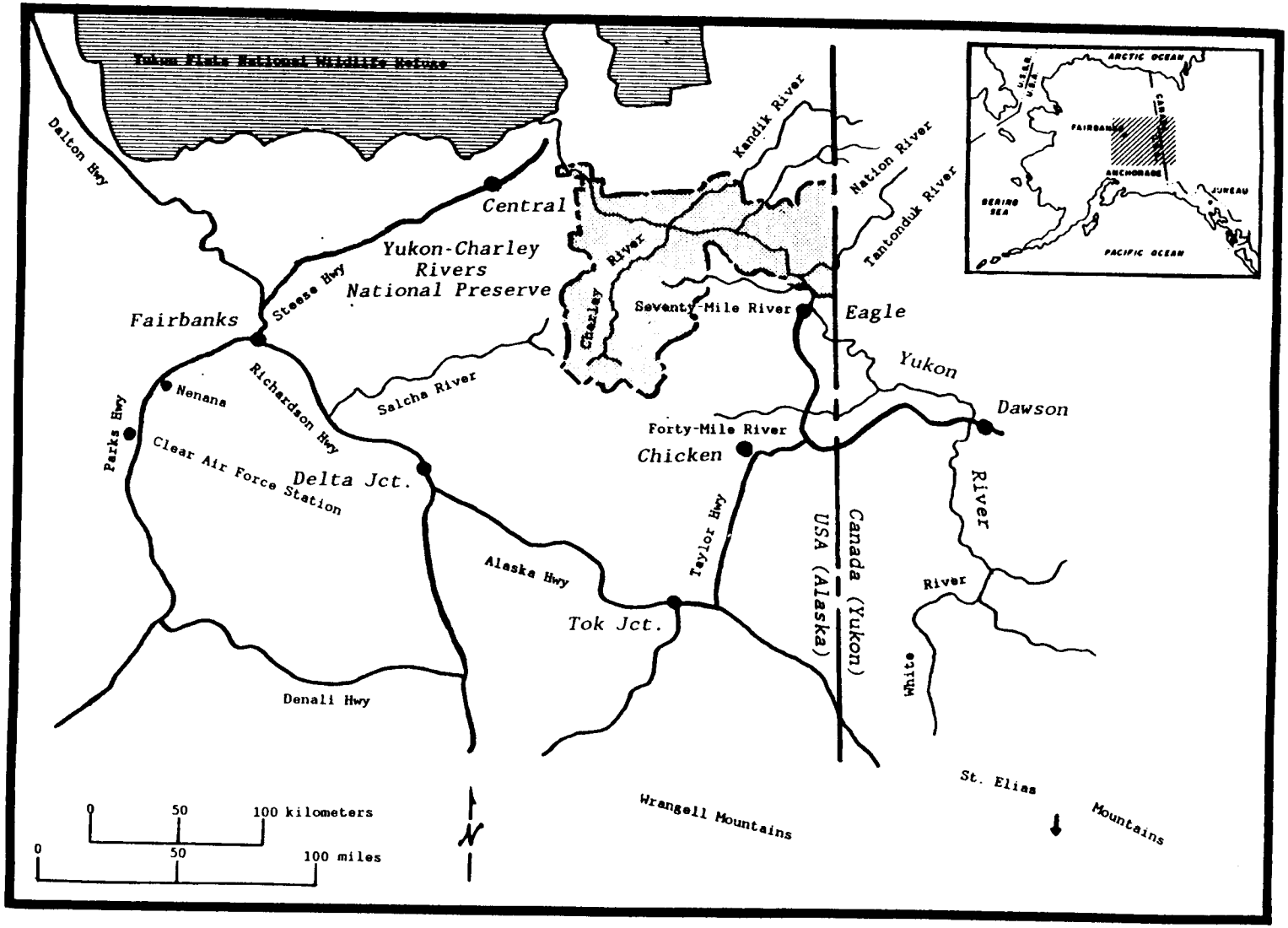


Figure 8. Major highways in interior Alaska.

disturbance. Vegetation insulates permafrost soils, and melting can occur when it is removed (Selkregg 1976).

Climate

Climate in the area is one of harsh contrasts, with spring coming as early as mid-April and snowfall, with sub-freezing temperatures, occurring as late as June. Summers are three months in duration and are characterized by long daylight hours and temperatures occasionally exceeding 32°C. The fall season may extend through early October, with snowfall and decreasing temperatures. Winter lasts from mid-November until mid-March, and during this time temperatures may fall to -57°C. Annual precipitation averages around 28 cm, with most precipitation falling between June and September (USDA 1989).

Species of Importance to the Sport Fishery

There are 17 fish species known in the Tanana area of which 10 are important sport species. They include: chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, Arctic grayling *Thymallus arcticus*, burbot *Lota lota*, lake trout *Salvelinus namaycush*, inconnu (sheefish) *Stenodus leucichthys*, least cisco *Coregonus sardinella*, humpback whitefish *Coregonus pidscian*, and northern pike *Esox lucius*. Rainbow trout *Oncorhynchus mykiss* are not native to the drainage, but have been stocked in several locations.

Tanana Area Sport Fisheries

The statewide harvest survey (SWHS), compiled annually since 1977 by Mills (1979-1990) serves as the basic reference of effort and harvest in AYK Region fisheries. Many important Tanana Area fisheries are not monitored by ADFG creel surveys, and several are monitored only to obtain CPUE (catch-per-unit-effort) and biological catch composition data, but not seasonal harvest totals. Because so few fisheries can be monitored by creel survey, the statewide survey is the only source of harvest information. Comparison of available harvest estimates from creel surveys with those from the SWHS, (Table 1) indicates that similar harvest estimates resulted.

Most harvest and effort data presented in this report are based upon the Alaska statewide sport fish harvest report (Mills 1990). Mills (1990) estimated annual harvests for 19 separate locations within the Tanana drainage. SWHS estimates are based upon responses to postal surveys sent to a random sample of resident and nonresident Sport Fish license holders. Approximately 4% of all sport fishing license holders were surveyed annually until 1989, when the sample size was approximately doubled and 8.7% of all anglers received questionnaires. A total of 28,422 questionnaires were mailed in 1989, followed by two reminders to non-respondents. Responses were obtained from more than 57% of the individuals that received the first mailing.

Results of the 1989 SWHS for the Tanana River drainage fisheries were based on responses received from several hundred people (Mills 1990). In 1989, the proportion of the total number of angler-days spent in the Tanana Area was 78% and 11% of the total number of all angler-days spent in the AYK Region and the

Table 1. Comparison of 1989 Alaska Sport Fish Survey and Tanana River drainage creel survey harvest estimates.

Fishery	Creel survey	Harvest survey[a]	
	Harvest	Harvest	95% Confidence Interval
Upper Chena River			
Arctic grayling	3,325	5,441	4,118 - 7,014
Chatanika River			
whitefish	16,038	15,542	11,930 - 19,438
Salcha River			
chinook salmon	123	231	134 - 356
Chena River			
chinook salmon	685	356[b]	164 - 587

[a] Statewide sport fish harvest survey (Mills 1990).
[b] Estimate is for anadromous chinook salmon less than 406 mm (16 in) in length

entire state of Alaska, respectively (Table 2). Of the 1,502,163 fish harvested in freshwater (includes anadromous salmonids) in the state, 188,045 (13%) were taken from the Tanana River drainage, and 66,075 (4%) were taken from the AYK Area (Table 2).

An average of approximately 72% of the sport fish harvested in the AYK Region is taken from the Tanana Area (Mills 1977-1990). Effort in angler-days in the Tanana Area has increased from 100,000 in 1977 to more than 186,000 in 1989. Since 1988 the harvest of stocked fish has exceeded that of wild stocks in the Tanana Area. A brief description of the sport fisheries in the Tanana Area follows.

Chinook Salmon:

Sport fishing for sea-run chinook salmon in the Tanana River drainage is largely limited to the lower sections of the Salcha and Chena rivers and to the upper Chatanika River, since these are essentially the only road-accessible stocks of sufficient size to support recreational harvests. Annual sport harvests in the Salcha River since 1980 have ranged between zero (1988) and 904 (1980) chinook salmon, while harvests in the Chena and Chatanika rivers are generally smaller. Harvest estimates by the SWHS, of chinook salmon in both the Chena and Salcha rivers, differed substantially in 1989 from those obtained by the creel survey study (Table 1). The sport harvest estimated by creel survey for the lower Chena River was larger (685 chinook salmon, Table 3) than the harvest estimated by the SWHS (356 chinook salmon, Mills 1990). The creel survey estimated a sport harvest of 123 chinook salmon in the Salcha River in 1989 (Table 3), compared to an estimated 231 by the SWHS (Mills 1990; Table 4).

Separate harvest estimates for chinook salmon less than 41 cm (16 in) have been made in the SWHS since 1988. These estimates include only small anadromous chinook salmon. Harvest estimates of small chinook salmon taken from stocked lakes are included with landlocked coho salmon. Mills (1990) estimates that 500 small anadromous chinook salmon were harvested in the Tanana River drainage in 1989, the majority from the lower Chena River, where no large chinook salmon were estimated in the sport harvest.

Salcha River spawning escapement in 1989 was estimated[1] to be within the range desired by ADFG for reproductive purposes. Escapements estimated by aerial survey that range from 1,500 to 3,500 adult spawning fish are considered desirable, and the peak aerial escapement estimate of 2,333 chinook salmon in 1989 (observed on 30 July) is within that range. Since 1980, escapements in this river have ranged from as few as 1,031 to as many as 6,757 chinook salmon under good survey conditions. The average escapement from 1980 to 1989 (nine data points), is 2,742 chinook salmon. Chena River chinook salmon escapement in 1989 was estimated to be 1,180 fish, the fewest since 1980. Escapement estimates from aerial surveys have ranged from 1,180 to 2,553 fish, with an average (six data points) of 2,144 fish per year. Escapement objectives (estimated by aerial survey) for the Chena River have been set at 1,000 to 1,700 chinook salmon, and the 1989 escapement was within that range.

---

[1] Estimated by aerial survey

Table 2. Number of sport anglers, fishing trips, angler days and total freshwater[a] fish harvested in the Tanana River drainage, AYK and the entire state of Alaska, 1989[b].

	Tanana Drainage	AYK[c]	Alaska
Number Sport Anglers	38,845	9,860	391,308
Number Fishing Trips	136,116	33,565	1,731,202
Number Angler Days	186,418	53,374	2,264,079
Total Fish Harvested	188,045	63,651	1,502,163

[a] Includes anadromous salmonids.
[b] Mills 1990.
[c] Exclusive of Tanana River drainage.

Table 3. AYK Region creel surveys, 1989.

Water Body/Fishery	Species[a]	Date(s)	Effort (hours)	HPUE[b]	Harvest
Chatanika River campground	LC	12 Sept-14 Oct	2,200[b]	1.62	3,750
Chatanika River ditch	LC	11 Sept-15 Oct	3,484[b]	1.70	6,034
Chatanika River campground	HW	12 Sept-14 Oct	2,200[b]	0.46	1,099
Chatanika River ditch	HW	11 Sept-15 Oct	3,484[b]	0.76	2,547
Chatanika River Steese Hwy	HW	12 Sept-10 Oct	266[b]	0.75	189
Chena River	GR	19 May-13 Sept	11,349	0.21	3,325
Chena River	KS	07 Jul- 30 Jul	4,938	0.15	685
Delta Clearwater River	GR	05 Jun- 31 Aug	ND	N	ND
Piledriver Slough	RT	1 May- 31 Aug	ND	0.15	ND
Piledriver Slough	GR	1 May- 31 Aug	ND	0.05	ND
Salcha River	KS	07 Jul- 30 Jul	5,606	0.02	123
Harding Lake	AC	23 Dec- 25 Mar	246	0.17	49[c]
Harding Lake	NP	02 Jun- 24 Aug	6,249	ND	665

[a] CS: chum salmon; GR: Arctic grayling; HW: Humpback whitefish; KS: chinook salmon; LC: least cisco; RT: rainbow trout; AC: Arctic char; NP: northern pike.

[b] Harvest per unit effort data for all whitefish species.

[c] There was a reported harvest of 149 Arctic char prior to initiation of the creel survey.

Table 4. Tanana Management Area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	KI[d]	KS	SS	LL	CS	LT	DV/ AC	RT	GR	WF	SF	NP	BB	OTHER
Upper Chena River[e]	6,439	8,780	10,014	19	0	0	0	0	0	0	0	5,441	155	0	110	100	16
Lower Chena River[f]	6,585	17,040	20,317	356	0	0	0	48	0	0	0	7,194	60	22	902	1,222	0
Badger Slough[g]	1,805	4,032	7,231	0	0	0	0	0	0	0	0	1,102	328	0	291	0	0
Piledriver Slough	5,268	19,512	22,746	19	0	0	0	19	0	0	7,689	4,459	60	0	80	100	0
Nenana River Drainage	813	1,366	1,719	10	29	192	0	77	0	250	0	1,804	34	0	50	60	0
Chatanika River	6,358	10,667	12,210	19	212	0	0	58	0	0	0	6,934	15,542	89	812	10	0
Salcha River	3,870	6,016	9,704	29	202	0	0	385	0	0	0	5,721	362	0	90	0	0
Delta Clearwater River	2,845	4,585	5,368	0	0	1,049	0	29	0	0	0	3,016	34	0	0	0	0
Goodpaster River	797	1,935	1,930	0	0	0	0	0	0	0	0	1,964	0	0	10	120	0
Brushkana Creek	732	585	887	0	0	0	0	0	0	43	0	1,383	0	0	0	0	0
Tanana River	2,601	3,708	4,850	38	20	0	0	423	0	109	0	1,121	68	33	521	2,325	0
Shaw Creek	488	504	488	0	0	0	0	0	0	0	0	411	0	0	20	170	0
Richardson Clearwater R.	390	520	1,364	0	0	0	0	0	0	0	0	972	52	0	0	0	0
Delta River (below Tangle Lakes)	293	228	388	0	0	0	0	0	11	0	0	481	0	0	0	0	0
Other Streams	2,573	3,807	6,168	10	0	336	0	95	0	152	358	3,292	137	300	470	100	98
Birch Lake	7,740	10,569	14,284	0	0	0	4,982	0	0	0	16,420	0	0	0	0	0	0
Quartz Lake	9,886	12,748	18,299	0	0	0	9,593	0	0	0	27,356	0	0	0	0	0	0
Fielding Lake	1,398	894	1,664	0	0	0	0	0	195	0	0	1,283	0	0	0	0	0
Minto Flats	683	602	699	0	0	0	0	0	0	0	0	10	0	11	872	20	0
Tangle Lakes	3,658	2,277	3,991	0	0	0	0	0	478	0	0	3,136	43	0	0	0	0
Chena Lake (Lake only)	4,764	8,439	16,180	0	0	0	2,468	0	0	0	11,968	0	0	0	0	0	16
Harding Lake	2,976	4,098	4,935	0	0	0	0	0	119	141	456	0	0	0	1,764	10	0
Dune Lake	1,008	1,528	2,296	0	0	0	1,010	0	0	0	1,705	591	17	0	0	0	0
East Twin Lake	504	488	765	0	0	0	0	0	0	0	0	0	0	0	832	0	0
George Lake	488	406	610	0	0	0	0	0	0	0	0	10	0	0	882	20	0
Cool Lake	374	358	433	0	0	0	0	0	0	0	1,358	0	0	0	0	0	0
Healy Lake	374	406	954	0	0	0	0	0	0	0	0	0	0	0	1,393	0	0
Other Lakes	5,629	10,018	15,924	0	0	19	561	0	1,129	218	7,365	4,498	43	188	2,231	100	0
TOTAL	38,845[h]	136,116	186,418	500	463	1,596	18,614	1,134	1,932	913	74,675	54,823	16,935	643	11,330	4,357	130

[a] Tanana River Drainage (Area U): All southern drainages of the Yukon River from its confluence with the Tanana River, near Tanana, to the Canadian border; including the entire Tanana River drainage, and the Alaskan portion of the White River drainage.

[b] KS: chinook salmon; SS: coho salmon; LL: landlocked coho or chinook salmon; CS: chum salmon; LT: lake trout; DV/AC: Dolly Varden or Arctic char; RT: rainbow trout; GR: Arctic grayling; WF: whitefish of various species; SF: Inconnu (sheefish); NP: northern pike; BB: burbot.

[c] From Mills 1990.

[d] Chinook salmon less than 410 mm (16 inches).

[e] The Chena River and tributaries accessed from the Chena Hot Springs Road beyond Milepost 25 on the road.

[f] The Chena River and tributaries from the mouth upstream to Milepost 25 of the Chena Hot Springs Road.

[g] All parts of Badger Slough (sometimes called Chena Slough).

[h] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Coho Salmon:

Anadromous coho salmon are taken in the Delta Clearwater River and from various creeks in the Nenana River drainage. Coho salmon spawn in other clear spring-fed tributaries of the Tanana River where little sport effort occurs. The Kantishna River and Toklat River tributaries such as Moose, Barton, and Geiger creeks, and the Sushana River (Figure 2), where artesian waters are found, support coho salmon populations. The largest sport harvest in the Tanana Area occurred in 1988 when an estimated 2,237 anadromous coho salmon were taken. The sport harvest in 1989 is estimated to have been 1,596 fish (Table 4). The Delta Clearwater River supports both the largest coho spawning population and the largest recreational harvest in the Tanana Area, where an estimated 1,049 fish were taken in 1989 (Table 4). The fishery in the Delta Clearwater River for coho salmon typically takes place from mid-September until the end of October.

Delta Clearwater River escapements have generally increased since 1985 when 5,358 coho salmon were estimated in the spawning population. Comparable escapement sizes for 1986, 1987, 1988, and 1989 were 10,857, 22,300, 21,600 and 11,000 fish respectively (Whitmore et al. 1990; Bergstrom et al. 1989). Escapement size since 1977 has ranged from 3,946 fish in 1980 to 22,300 fish in 1987. Commercial fishing restrictions in the lower Yukon River salmon fisheries, combined with excellent survival of adult coho salmon have apparently favored large escapements of this species to the Yukon and Tanana spawning grounds.

Stocking of landlocked coho salmon in Quartz, Birch, Chena and several smaller lakes has been popular with anglers in the Tanana River valley. An estimated 18,614 such fish were harvested from stocked lakes in 1989, with 9,593 taken from Quartz Lake alone (Table 4).

Arctic Grayling:

Arctic grayling are a widely distributed and popular sport species in the Tanana Area, inhabiting most of the flowing waters and many of the lakes of the drainage. Trout-like feeding characteristics make the Arctic grayling a favorite of anglers. Essentially all major clear water tributaries to the Tanana River support Arctic grayling populations. The largest Arctic grayling fisheries in the Tanana drainage occur in the Chena, Salcha, Chatanika, Goodpaster, Delta and Richardson Clearwater rivers; Badger and Piledriver sloughs; and Fielding and Tangle lakes. The Tangle lakes support the largest lacustrine fishery for Arctic grayling in Alaska.

Historically, the Chena River has supported the largest Arctic grayling fishery in the state, due to both an abundant stock, as well as to the proximity of the Chena River to Fairbanks and the many miles of road access. The average annual harvest of Arctic grayling in the Chena River exceeded 21,000 fish during the eight year period from 1977 to 1984. The harvest declined from a peak of 42,000 in 1980 to a low of 3,090 in 1987. Clark (1987) attributed declines in abundance and fishing success in the Chena River since 1984 to both sport fishing overharvest and to reduced recruitment

because of unfavorable environmental conditions (primarily high river discharge during the natal year). In 1989 the estimated sport harvest from the Chena River and its tributaries was 13,737 Arctic grayling (Table 4), an increase of more than double the 1988 harvest estimate of 5,328. Modest increases in survival and recruitment estimates for Chena River Arctic grayling have been reported by Clark (1990b) for 1988-1989, however abundance of fish 3 years old and older in the lower 152 km of the Chena River (estimated in July) was estimated to be only 16,236 fish. The sport harvest estimated in 1989 is unsustainable at current population levels, as it far exceeds recruitment for the 1988-1989 period, and is only somewhat less than the total population abundance estimated for the lower Chena River by Clark (1990).

Declines have been documented in several Tanana River drainage Arctic grayling fisheries and Shaw Creek, the Delta Clearwater River, Richardson Clearwater River and Chena River Arctic grayling stocks are considered examples of depleted stocks. In 1975, because of increased fishing effort associated with the influx of people for the construction of the trans-Alaska pipeline, the daily bag limit in the Tanana River drainage was decreased from 10 to five Arctic grayling. The reduction in bag limit in 1975 to five fish daily and 10 in possession did not prevent the decline of important Arctic grayling stocks nor did it increase or stabilize fishing success. Further restrictions were enacted in 1987, including a decrease in the possession limit to five Arctic grayling daily, corresponding to the daily bag limit.

In spite of large historic annual harvests in the Tanana Area, there have been no trophy Arctic grayling (larger than 1.4 kg, 3.0 lb) registered since the inception of the trophy program in the mid-1960's, while 102 individuals have been recorded from rest of the state. Growth rates of individual Arctic grayling in the Tanana River drainage are considered to be typical for Alaska, however, growth rates of Arctic grayling in Bristol Bay, and the Seward Peninsula, where the majority of the trophy fish have been taken, are exceptionally high. It is also possible that Tanana River drainage populations have been maintained at smaller individual size from steady fishing and natural mortality, so that even though growth rates are normal, larger individuals are removed before reaching minimum trophy size.

Northern Pike:

Northern pike are harvested by sport fishermen using hook and line gear in summer and winter as well as with spears during the winter. The majority of the Tanana Area harvest comes from lakes that have relatively good access. Important fishing areas are found in Minto Flats, northwest of Fairbanks (Figure 2) and in Harding, George, Healy and East Twin lakes (Figures 3 and 4). Through-the-ice fisheries that occur during the two months just prior to spring break-up, during the period when northern pike have gathered into spawning concentrations, account for a significant portion of the annual fishing mortality.

In 1989, the estimated sport harvest of northern pike in Harding Lake, Minto Flats (including Chatanika River), Healy Lake, George Lake, and East Twin Lake was 1,764, 1,684, 1,393, 882, and 832 fish respectively, accounting for about

58% of the harvest of 11,330 northern pike in the Tanana River drainage (Table 4).

Additional lakes and streams utilized by sportsmen in pursuit of this species include West Twin and Wien lakes in the Kantishna River drainage, Fish Lake near the Tanana-Yukon confluence, Volkmar Lake near Delta, Wellesley, Dog, Jatahmund, Island, and Deadman lakes, Moose and Scotty creeks in the vicinity of Northway (Figures 2 and 6), and other tributary streams of the Tanana River including the Chena River.

Harvest and effort have increased for northern pike in the past ten years. Angler surveys indicate that this species is the second most sought-after indigenous sport fish species in interior Alaska, and it is estimated that more than 20,000 anglers fished for northern pike in the Tanana Area during 1986 (Holmes and Pearse 1987). The total sport harvest of northern pike within the Tanana River drainage has remained relatively stable over the past ten years, from 8,000 to 12,000 fish annually although the distribution of the harvest has varied among various fishing sites. Because of the substantial increase in effort, however, the catch per angler day has decreased, and some stocks have been overfished. The estimated harvest of northern pike in the Tanana River drainage in 1989 (11,330 fish) constituted about 52% of the estimated statewide harvest (21,659) of this species (Mills 1990).

Recent studies of northern pike populations within the Tanana River drainage have found that exploitation rates are higher than sustainable in some populations. Even in populations where exploitation rates are not judged to be excessive (less than 20% per year) as in Volkmar Lake, the number of large fish has declined under only moderate harvest pressure. The Minto Flats population has been of special concern due to high additive estimated rates of exploitation in summer and winter subsistence and sport fisheries. Concern for increased harvest in the Minto Flats (Tolovana River drainage) resulted in a winter closure of the sport fishery beginning in the winter of 1987. New regulations, including a reduction in the daily bag limit from 10 to five fish and a winter sport fishery closure, have helped reduce sport harvests of northern pike in the Minto Flats since 1987. Harvest estimates were 1,492 northern pike in 1988 and 1,684 in 1989. Historical harvests from this wetlands complex were much higher, with estimates exceeding 4,600 and 4,900 northern pike in 1985 and 1986. A total of 56 (38%) of the statewide registered trophy northern pike (minimum weight of 6.8 kg, 15 lbs) was taken from the Tanana River drainage. The Chatanika River, Tolovana River and Minto Flats (considered parts of the Minto Flats complex) account for 23 (41%) of the Tanana River drainage trophy northern pike records, with 12 (21%) from East Twin Lake and eight (14%) from Volkmar Lake. The number of large pike taken from each area may be more reflective of relative amounts of fishing effort than of size and growth characteristics of the respective stock.

Lake Trout:

Lake trout are found in many of the lakes and some streams of the Delta and upper Tanana River drainages (Burr 1987). They most frequently inhabit deep, oligotrophic mountain lakes and are rarely found at lower elevations of the Tanana River drainage. Lakes of the Delta River drainage (Figure 5) including

Fielding, Landmark Gap, Glacier, Sevenmile, and the Tangle lakes contain lake trout. Transplanted lake trout occur in Harding Lake (Figure 4) near Fairbanks and although the small numbers do not support a large fishery, some large individuals have been taken. On average, 65% of the AYK Region lake trout harvest is taken from lakes in the Tanana River drainage. The regional lake trout harvest increased at an annual average rate of 27% from 1978 to 1985. An apparent major decline in abundance occurred and was first observed in 1986 in waters of the Tanana River drainage. Research in both southcentral and interior Alaska indicates that most of the road accessible stocks have undergone overexploitation in recent years.

Lake trout are a long lived, slow growing and late maturing species, and the potential impact of even a modest fishery can be significant. Lake trout older than 25 years are not uncommon and individuals older than 50 years are recorded for Alaska (Burr 1987). Trophy lake trout weighing 8.7 kg (20 lbs) or more are typically 20 or more years old (Burr 1987). Lake trout residing in high elevation lakes in the Alaska Range migrate into shallow rocky shoals to spawn in late fall. Lake trout spawn for the first time at ages ranging from 5 to 12 years of age, depending on growth conditions primarily, and alternate year spawning may be more normal than spawning in consecutive years in interior and northern Alaska.

Estimated lake trout harvest in the Tanana River drainage peaked at about 3,100 fish in 1982. Harvest declined to 713 and 652 in 1986 and 1987, after the bag limit was reduced from 12 to two lake trout per day (Table 2). After two years of reduced harvest, Mills (1989) estimated that the 1988 harvest of lake trout had increased to 2,221 fish (Table 5). However, further investigation of responses to the SWHS showed that harvests of lake trout were reported from lakes known to contain only stocked rainbow trout and/or Arctic char, particularly from those lakes on Eielson Air Force and Fort Greely Army bases. The more accurate estimate of 1988 native lake trout in the Tanana River drainage is 783 fish. Lake trout harvest estimates for the Tanana Area in 1989 total 1,932 fish of which 1,129 are reported from un-specified lake locations (Table 4). Examination of responses to the SWHS indicates that at least 434 lake trout included in the un-specified category can be omitted from the Tanana Area total because of reporting errors as reported above in 1988. A more accurate estimate of the Tanana Area lake trout harvest in 1989 is 1,498 fish. The largest harvest in the area (478 fish) is estimated to have been taken in the Tangle lakes.

Five trophy lake trout are recorded from the Tanana Area, three taken in Harding Lake, one each in Fielding and Upper Tangle lakes.

Burbot:

Burbot fishing has become increasingly popular with Alaskan anglers in recent years. The majority of the AYK Region harvest occurs in waters of the Tanana Area. Participation is mostly by local residents using baited setlines although hand-held fishing gear is also used. Most fishing in the Tanana River near Fairbanks occurs during the winter months while in the upper Tanana River drainage, a major portion of the annual harvest occurs in spring and summer. Burbot fishing occurs in streams, such as the Tanana, Chena and

Table 5. Arctic-Yukon-Kuskokwim Region sport fish harvests by species, 1978-1989[a].

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Tanana Area:												
Chinook Salmon	163	515	941	763	984	1,048	338	1,356	781	502	853	963
Sea-Run Coho Salmon	139	25	67	45	52	147	831	796	1,374	1,231	2,237	1,596
Landlocked Coho/ Chinook Salmon	22,412	36,073	25,733	57,294	43,374	34,255	29,245	41,042	24,061	26,566	32,342	18,614
Sockeye Salmon	0	0	0	0	0	0	0	0	0	0	0	0
Pink Salmon	0	0	0	0	0	0	0	0	0	0	0	0
Chum Salmon	158	219	483	595	698	649	585	1,255	693	620	491	1,134
Rainbow Trout	6,406	5,186	19,584	24,571	26,186	20,664	34,022	33,432	31,270	31,824	78,345	74,675
Lake Trout	603	946	1,264	1,721	3,104	2,937	2,104	2,984	713	652	2,221	1,932
Dolly Varden/ Arctic Char	524	364	524	572	482	293	350	1,230	200	36	909	913
Arctic Grayling	83,275	70,243	80,150	75,288	81,753	92,363	83,626	63,560	45,981	38,480	52,659	54,823
Northern Pike	7,838	7,975	9,452	9,941	9,822	10,225	9,607	12,090	11,934	9,471	11,986	11,330
Whitefish	6,573	5,159	5,987	4,873	8,643	8,311	11,658	20,230	26,810	26,435	11,775	16,935
Burbot	1,383	1,979	2,700	4,122	3,887	5,040	5,556	4,795	5,142	3,855	3,733	4,357
Sheefish	234	279	96	93	127	157	338	420	72	235	982	643
Other Fish	81	79	0	108	10	21	39	0	171	0	0	130
Total	129,789	129,042	146,981	179,986	179,122	176,110	178,299	183,190	149,202	139,907	198,533	188,045

-continued-

Table 5. (Page 2 of 3).

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
AYK Area:												
Chinook Salmon	932	644	939	1,112	1,530	2,649	1,481	1,331	2,079	1,691	2,965	2,450
Sea-Run Coho Salmon	1,308	2,958	3,469	2,087	5,909	5,785	11,205	2,396	7,319	7,210	9,713	8,655
Landlocked Coho/ Chinook Salmon	0	0	0	0	0	0	0	0	0	58	0	0
Sockeye Salmon	85	126	112	117	430	261	650	169	439	1,364	1,528	456
Pink Salmon	8,328	2,918	7,844	3,118	14,214	5,286	8,712	1,206	3,404	1,322	3,859	3,765
Chum Salmon	1,834	1,482	2,290	3,045	5,083	4,049	2,689	1,781	3,643	2,148	3,201	4,748
Rainbow Trout	362	401	835	982	796	1,783	1,455	659	504	592	1,599	757
Lake Trout	497	655	1,025	1,100	2,023	1,157	1,520	2,370	2,537	461	509	1,955
Dolly Varden/ Arctic Char	4,014	8,144	8,273	8,176	13,647	20,324	12,882	13,430	10,173	12,333	11,238	13,359
Arctic Grayling	11,289	19,229	20,396	20,892	27,043	30,800	15,516	17,666	19,744	19,476	16,302	17,215
Northern Pike	3,915	4,004	6,190	5,184	7,435	8,609	4,610	3,613	7,062	4,751	7,838	5,853
Whitefish	909	855	1,705	576	3,708	4,746	234	630	4,960	724	1,855	1,997
Burbot	506	118	663	684	1,896	555	377	420	469	162	145	537
Sheefish	1,057	1,263	2,315	2,146	3,154	3,166	3,609	2,100	3,649	2,362	2,239	1,663
Smelt	0	0	0	0	0	0	0	8,750	464	7,080	2,476	2,424
Halibut	0	0	0	0	0	0	0	62	0	36	0	0
Other Fish	1,212	2,218	3,513	3,124	8,551	8,806	1,844	1,336	1,178	0	371	241
Total	36,248	45,015	59,569	52,343	95,419	97,976	66,784	57,919	67,624	61,770	65,838	66,075

-continued-

Table 5. (Page 3 of 3).

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
AYK Region (both management areas):												
Chinook Salmon	1,095	1,159	1,880	1,875	2,514	3,697	1,819	2,687	2,860	2,193	3,818	3,413
Sea-Run Coho Salmon	1,447	2,983	3,536	2,132	5,961	5,932	12,036	3,192	8,693	8,441	11,950	10,251
Landlocked Coho/ Chinook Salmon	22,412	36,073	25,733	57,294	43,374	34,255	29,245	41,042	24,061	26,624	32,342	18,614
Sockeye Salmon	85	126	112	117	430	261	650	169	439	1,364	1,528	456
Pink Salmon	8,328	2,918	7,844	3,118	14,214	5,286	8,712	1,206	3,404	1,322	3,859	3,765
Chum Salmon	1,992	1,701	2,773	3,640	5,781	4,698	3,274	3,036	4,336	2,768	3,692	5,882
Rainbow Trout	6,768	5,587	20,419	25,553	26,982	22,447	35,477	34,091	31,774	32,416	79,944	75,432
Lake Trout	1,100	1,601	2,289	2,821	5,127	4,094	3,624	5,354	3,250	1,113	2,730	3,887
Dolly Varden/ Arctic Char	4,538	8,508	8,797	8,748	14,129	20,617	13,232	14,660	10,373	12,369	12,147	14,272
Arctic Grayling	94,564	89,472	100,546	96,180	108,796	123,163	99,142	81,226	65,725	57,956	68,961	72,038
Northern Pike	11,753	11,979	15,642	15,125	17,257	18,834	14,217	15,703	18,996	14,222	19,824	17,183
Whitefish	7,482	6,014	7,692	5,449	12,351	13,057	11,892	20,860	31,770	27,159	13,630	18,932
Burbot	1,889	2,097	3,363	4,806	5,783	5,595	5,933	5,215	5,611	4,017	3,878	4,894
Sheefish	1,291	1,542	2,411	2,239	3,281	3,323	3,947	2,520	3,721	2,597	3,221	2,306
Smelt	0	0	0	0	0	0	0	8,750	464	7,080	2,476	2,424
Halibut	0	0	0	0	0	0	0	62	0	36	0	0
Other Fish	1,293	2,297	3,513	3,232	8,561	8,827	1,883	1,336	1,349	0	371	371
Total	166,037	174,057	206,550	232,329	274,541	274,086	245,083	241,109	216,826	201,677	264,371	254,120

[a] From Mills 1990

Tolovana rivers, and in lakes. In past years, the most heavily fished lakes were Fielding, Harding, and Tangle lakes. Since 1987, bag limits in these lakes were reduced to two fish daily, and use of set lines was eliminated. The Tanana River supports one of the largest burbot fisheries in the state, and only the burbot fisheries in the Glennallen area are comparable. Although Tanana River burbot harvest rates are not considered excessive, studies of harvest rates and abundance in lakes of the drainage suggest low stock abundance in most of the lakes examined. Population density of burbot in lakes declined dramatically in the early 1980's due to unsustainable rates of sport fishing exploitation. Burbot research in Fielding Lake indicates that only modest recovery of the population has taken place, even with minimum fishing pressure (Parker et al. 1989). Burbot stocks in the Tanana River are generally exploited near population centers such as Fairbanks, Delta Junction, and near Northway. Burbot movements within the Tanana River tend to minimize effects of concentrated local fishing effort, and stocks in the Tanana River appear to be lightly exploited (Evenson 1990).

To prevent further declines in burbot populations in lakes of the Tanana drainage, the Department implemented emergency regulations in 1987 to prohibit the use of set lines from 15 May to 15 October, and to reduce the bag and possession limit in all Tanana drainage lakes to five fish. Also, a ban on the use of set lines throughout the entire year was enacted for Harding, Fielding, T, and Tangle lakes along with a further reduction in the bag and possession to two burbot daily in these waters. The estimated harvest of burbot in the Tanana River drainage by sport anglers in 1989 was 4,357 fish. The majority (3,547 fish) of the harvest was taken in the Tanana River and the lower Chena River (Table 4).

Of the 139 trophy burbot registered in Alaska, (minimum size 3.6 kg, 8 lbs) 78 (56%) were taken in the Tanana Area, and the majority of those were taken near Fairbanks in the Tanana (53, 38%) and Chena (20, 14%) rivers.

Whitefish:

Most of the statewide recreational whitefish harvest occurs in the AYK Region. The Tanana Area sport harvest of whitefish is almost entirely from the Chatanika River, tributary to the Tolovana River, itself a tributary of the Tanana River, where an active spear fishery occurs in the fall. Hook and line techniques are also used here and in other places to capture whitefish, in which small baited hooks are drifted along the stream bottom.

The estimated 1989 harvest of Tanana Area whitefish was 16,935 fish, with more than 15,000 taken from the Chatanika River (Table 4). The creel survey estimated a harvest of 16,068 whitefish of all species in the Chatanika River spear fishery in 1989, of which 9,784 were least cisco and 3,835 were humpback whitefish, and 2,419 were of other species, including round whitefish *Prosopium cylindraceum* (Table 1, Table 3). This is a substantially larger harvest than in 1988 when about 8,000 whitefish were harvested.

The Chatanika River supports spawning populations of humpback whitefish, least cisco, and round whitefish. During late summer and fall, these fish migrate upstream from Minto Flats to spawn. By freeze-up in approximately mid-

October, the adult whitefish have departed for wintering areas that are as yet unidentified, and which may be located downstream of the Chatanika River. It is not known whether the Chatanika River itself is an important habitat for whitefish other than during spawning and the egg-fry development stages.

Harvest levels have increased steadily since 1981 when the total estimated harvest was approximately 5,000 whitefish. Since 1977, harvest of whitefish from the Chatanika River has increased at an average annual rate of 34%, making it the fastest growing recreational fishery in the Tanana River drainage (Hallberg and Holmes 1987). Approximately 5,950 angler-hours of effort were expended to spear whitefish in 1989, an increase of about 33% over 1988. Fishing conditions were ideal in 1989 with low and clear river stages through much of the period, which may have enhanced the harvest and effort levels. Estimated maximum exploitation rate of humpback whitefish in 1989 was 22%, versus 18% for least cisco. Abundance estimates upon which the calculation of exploitation rates are based were restricted to a section of the Chatanika River near the location of the fishery, and consequently, the abundance estimate cannot be considered germane to the entire river and its stocks of whitefish (Timmons 1990). Prior to 1987 no bag or possession limits were in effect for whitefish in the AYK Region A daily limit of 15 whitefish for the waters of the Tanana River drainage was enacted in 1987 and went into effect in 1988. It was hoped that the new regulations would have the effect of not only reducing harvest but also that exploitation rates would be limited to no more than 20%, a level thought to be sustainable for these species.

Sheefish:

Spawning stocks of sheefish in the Tanana River drainage have been documented only in the upper Chatanika River (Alt 1987). Tagging studies from 1967 to 1971 indicated that sheefish that spawned in the Chatanika River also spent the summer feeding in Minto Flats (Alt 1987). Recaptures in the lower Chena River and at Nenana, of fish that were tagged in the Chatanika River, showed that sheefish disperse widely in the areas adjacent to spawning. Sheefish are widely distributed in the Tanana River drainage during the open water season, from the Tanana River mouth to more than 300 km upstream of Fairbanks. They have also been found at the mouths of the Bearpaw and Toklat rivers in the Kantishna River drainage. Typically sheefish are taken in the lower reaches of clear water tributaries such as the Chena, Chatanika, Tolovana, and Tatalina rivers as well as others. Total sport harvest of sheefish in the Tanana River drainage in 1989 was estimated to be 643 fish (Table 4).

Attempts to stock lakes with sheefish in the Tanana River drainage to create new sport fisheries have met with little success. Harding Lake was stocked nearly annually from 1982 through 1989 (with the exception of 1984). No returns to the sport fishery have been documented and stocking for the purpose of fisheries enhancement will probably discontinue in future years. On the other hand, good growth and survival of stocked sheefish was reported from Four Mile Lake (Figure 3) along the Taylor Highway from stocking events in 1968 and 1969 (Alt 1981) The appearance of new age classes led Peckham and Doxey (1983) to speculate that natural reproduction had occurred.

Rainbow Trout:

Rainbow trout are not indigenous to the Yukon River drainage but have been introduced in several locations, including about 75 Tanana Area lakes since the 1950's. There is no evidence that natural reproduction has taken place.

Piledriver Slough has been stocked with rainbow trout since 1987. The slough was formerly connected to the Tanana River and is located about 30 km south of Fairbanks (Figure 2). Water in the slough became clear when the Army Corps of Engineers blocked Tanana River water from entering the upper end at several locations in 1976. The slough was blocked in conjunction with the Army Corps of Engineers Chena Flood Control Project to prevent spillage of high water discharge from the Tanana River into the floodway channel during construction. The temporary dikes are still in place, although they have not been maintained. Piledriver Slough, fed by groundwater from the Tanana River valley, re-established itself as a clear-water tributary to Moose Creek which discharges directly into the Tanana River. Arctic grayling, whitefish and long-nosed suckers *Catostomus catostomus* were found inhabiting Piledriver Slough within a year after its upper end was blocked. The objective of stocking was to create a consumptive stream rainbow trout fishery in Alaska's interior, thus providing more diversity in angling opportunity for interior anglers. This was the first documented time rainbow trout had been released into flowing waters in interior Alaska since statehood.

The harvest of rainbow trout in Piledriver Slough by sport anglers in 1989 was estimated to be 7,689 fish, while approximately 75,000 rainbow trout were taken in the Tanana Area including Piledriver Slough (Table 4). Angler effort (number of days fishing) on Piledriver Slough in 1988 exceeded 23,000, the largest amount of effort for any single water body in the Tanana Area (Table 4).

Substantial harvests of rainbow trout occur in Quartz, Birch, and Chena lakes. The largest harvest occurred in Quartz Lake, where an estimated 27,356 rainbow trout were taken (Table 4). The Tanana Area harvest of rainbow trout in 1988 of more than 78,000 fish represented an historical high value, and the 1989 harvest estimate was only marginally smaller (Table 4). The steady rise in harvest of this species reflects the successful expansion of the stocking program in the Tanana River valley.

Trophy rainbow trout (minimum size 6.8 kg, 15 lbs) have not been recorded from interior Alaska streams or lakes, and most of the registered trophy fish are native anadromous rainbow trout (steelhead) taken in coastal streams. Nevertheless, good growth rates and size have been achieved in some enhanced lake situations. The largest rainbow trout recorded in the Tanana Area was taken in 1980 from Quartz Lake. It reached a size of 4.5 kg (9.8 lbs). Rainbow trout exceeding 2.3 kg (5 lbs) are commonly taken from area lakes.

ARCTIC, YUKON, AND KUSKOKWIM AREA DESCRIPTION

Excluding the Tanana River drainage which comprises a little over 10% of the land area of the AYK Region, the AYK Area consists of some 870,000 km^2 (58% of

the entire land area of Alaska) of extremely varied topography, climate, and zoogeography. Land ownership and jurisdictions fragment this huge area into a complex mosaic. The federal government is the major land manager through its jurisdiction over the land withdrawals for National Parks and Preserves, National Wildlife Refuges, and Wild and Scenic Rivers. Native corporations, State of Alaska and private lands comprise the rest. The State of Alaska, by virtue of the Statehood Act retains authority to manage fisheries and wildlife on all lands and waters of the state. For purposes of reporting and organizing statistics in the SWHS, the AYK Area is subdivided into five sub-areas; Lower Yukon-Kuskokwim, Seward Peninsula-Norton Sound, Northwest Alaska, South Slope of the Brooks Range, and North Slope of the Brooks Range (Figure 1).

Geographic and Geologic Setting

Dominant features of the huge landmass that lies north of the Alaska Range divide include the Alaska Range itself which provides water for streams in the Kuskokwim drainage and to the Tanana River and its tributaries. The Brooks Range and its drainages provide water to the Noatak, Kobuk, Colville, Koyukuk, and Porcupine rivers as well as to many other streams that drain directly into the Yukon River or the Arctic Ocean and the Chukchi Sea.

The Yukon is the largest river in Alaska and its drainage constitutes the fifth largest in North America. The river originates in the basin and range domain of the southern Yukon Territories and northern British Columbia, and flows over 3,700 km northwest to its mouth on the Bering Sea coast. Additional Canadian flows to the upper Yukon River watershed are added from glacial streams such as the White River which originates in the Wrangell and St. Elias Mountain ranges. Approximately one-third of the Yukon River watershed is in Canada. The total drainage area of the Yukon River is approximately 855,000 km^2, including the area in Canada. Approximately three-fourths of the land area of the AYK Region is encompassed in the Yukon River drainage. The entire mainstem of the Yukon River up to the confluence of the White River (Figure 8) in Canada is turbid from glacial silt entrained in the waters draining the Alaska, St. Elias, and Wrangell Mountain ranges.

Lake and Stream Resources

Sport fishing waters and opportunities are extremely varied as could be expected in an area so large and diverse. In the following section the primary fishing waters and species of interest will be briefly characterized for each of the five sub-areas within the AYK Area. It is recognized that not all streams, lakes, or fish stocks of importance receive attention in this cursory treatment.

Lower Yukon and Kuskokwim River Sub-area:

The Lower Yukon-Kuskokwim sub-area (statewide harvest Area V; Figure 1) includes all southern drainages of the Yukon River from its confluence with the Tanana River, near Tanana, west to Kaltag; all north and south drainages of the Yukon River south of Kaltag to the Bering Sea; the Kuskokwim River watershed; all waters flowing into Kuskokwim Bay; and adjacent salt water and

islands. The sub-area has also been referred to as the Interior sub-area in some reports. This sub-area does not include the Pastolik River drainage and waters flowing into Norton Sound northeast of the Pastolik River nor any portion of the Tanana River watershed[2]. The Lower Yukon-Kuskokwim sub-area excludes the Koyukuk and Porcupine River drainages because they drain the south slope of the Brooks Range. It should also be noted that prior to 1984 the boundaries of the sub-area were such that the Arctic Circle was utilized as a northern limit. Now the northern limit of the Lower Yukon-Kuskokwim sub-area extends from Kaltag along the Yukon River to the confluence with the Tanana River (Mills 1985).

The primary flowing waters of the sub-area are the mainstems of the Yukon and Kuskokwim rivers and their tributaries. The Holitna River is the most productive stream for sport fishing in the Kuskokwim River drainage (Figure 9) above the Aniak River confluence, because of the diversity and abundance of its resident and anadromous species. Approximately six fishing guides provide services on the river to about 75 clients per year (Rue et al. 1987). No permanent lodge or tourist structures are present on the river. The Holitna River supports populations of Dolly Varden *Salvelinus malma*, Arctic grayling, northern pike, burbot, sheefish, various whitefish species and all five pacific salmon species. Rainbow trout do not occur in the Kuskokwim River drainage upstream of the Aniak River. Dolly Varden, coho salmon, and chinook salmon are the primary sport fish species in the Holitna River, although feeding sheefish are present in the summer as far upstream as the Hoholitna River (Alt 1987) and are sought by some anglers. The Stony, Swift, Gagaryah, Tatlawiksuk, Cheeneetnuk, and Hoholitna rivers are some of the other important middle Kuskokwim River tributaries. All originate in the Alaska Range and its foothills (Figure 9). Fishery resources of these streams are incompletely documented, and because of remoteness and limited access, they are thought to receive only light recreational use from sport anglers.

Upstream of McGrath, (Figure 10) in the upper Kuskokwim drainage, there are many tributaries that originate in the Alaska Range, such as the Big River, the Middle, South, Windy, Big Salmon, Slow, and East forks of the Kuskokwim River, as well as the Tonsona and Little Tonsona rivers and Highpower Creek near Telida. The North Fork, Nixon Fork, and Takotna rivers originate in the Kuskokwim Mountains west of the Kuskokwim River. Chinook, coho, and chum salmon *Oncorhynchus keta* spawn in streams of the upper Kuskokwim drainage, as do sheefish. Sheefish spawning has been documented in Big River and in Highpower Creek (Alt 1987). Although most of the primary sport fish species occur in the middle and upper Kuskokwim River drainage, (with the exception of rainbow trout), sport fishing effort is extremely light on most streams and fish stocks. Most fishing exploitation in the middle and upper part of the drainage occurs in local subsistence fisheries that mainly target salmon and whitefish.

---

[2] The Sport Fish Division assigns management responsibility for Kuskokwim Bay and Kuskokwim River waters upstream to Aniak to its Southcentral Region headquartered in Anchorage. Responsibility for these areas is assigned to Sport Fisheries staff stationed in Dillingham.

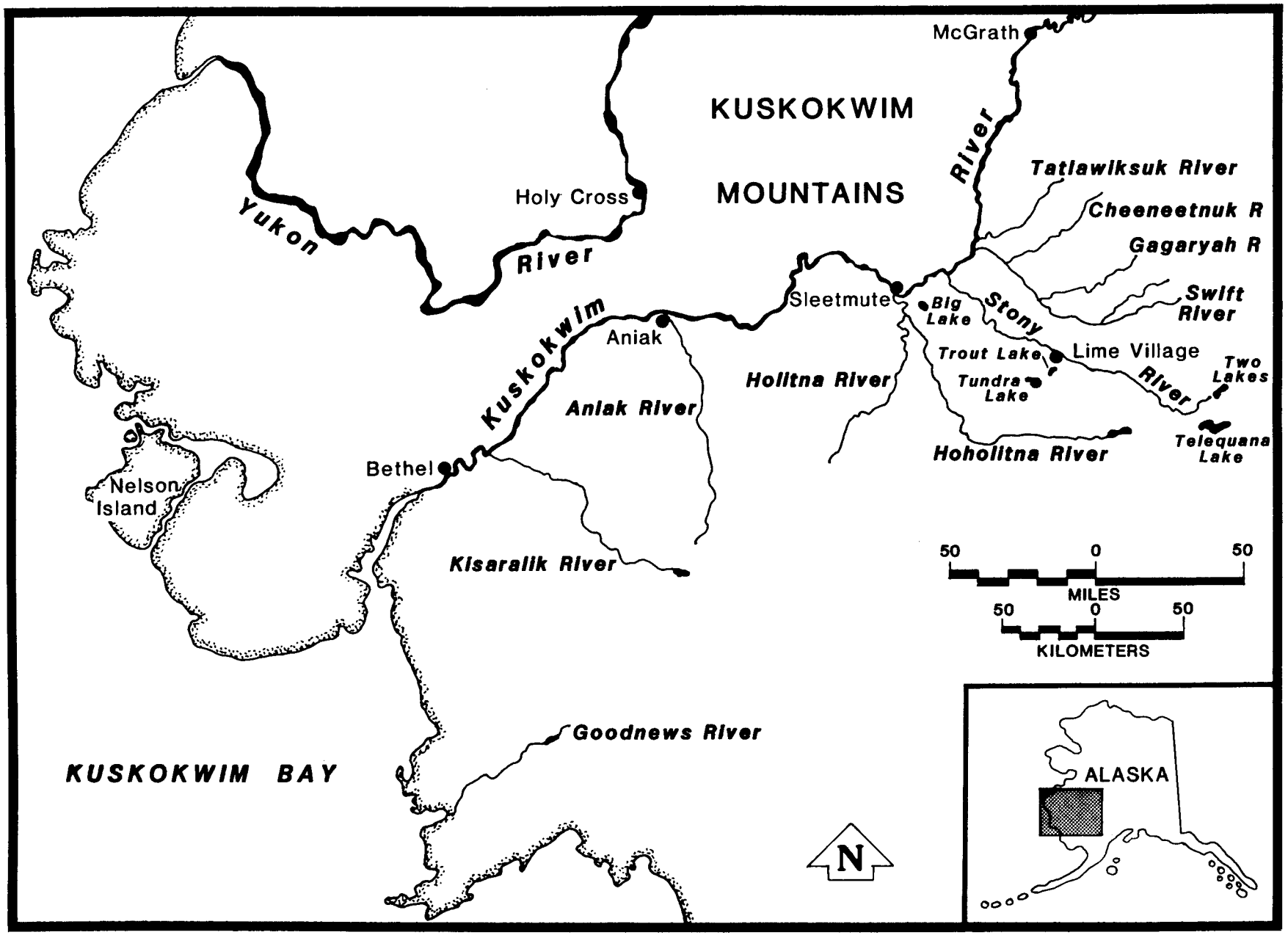


Figure 9. Waters of the lower Kuskokwim River valley.

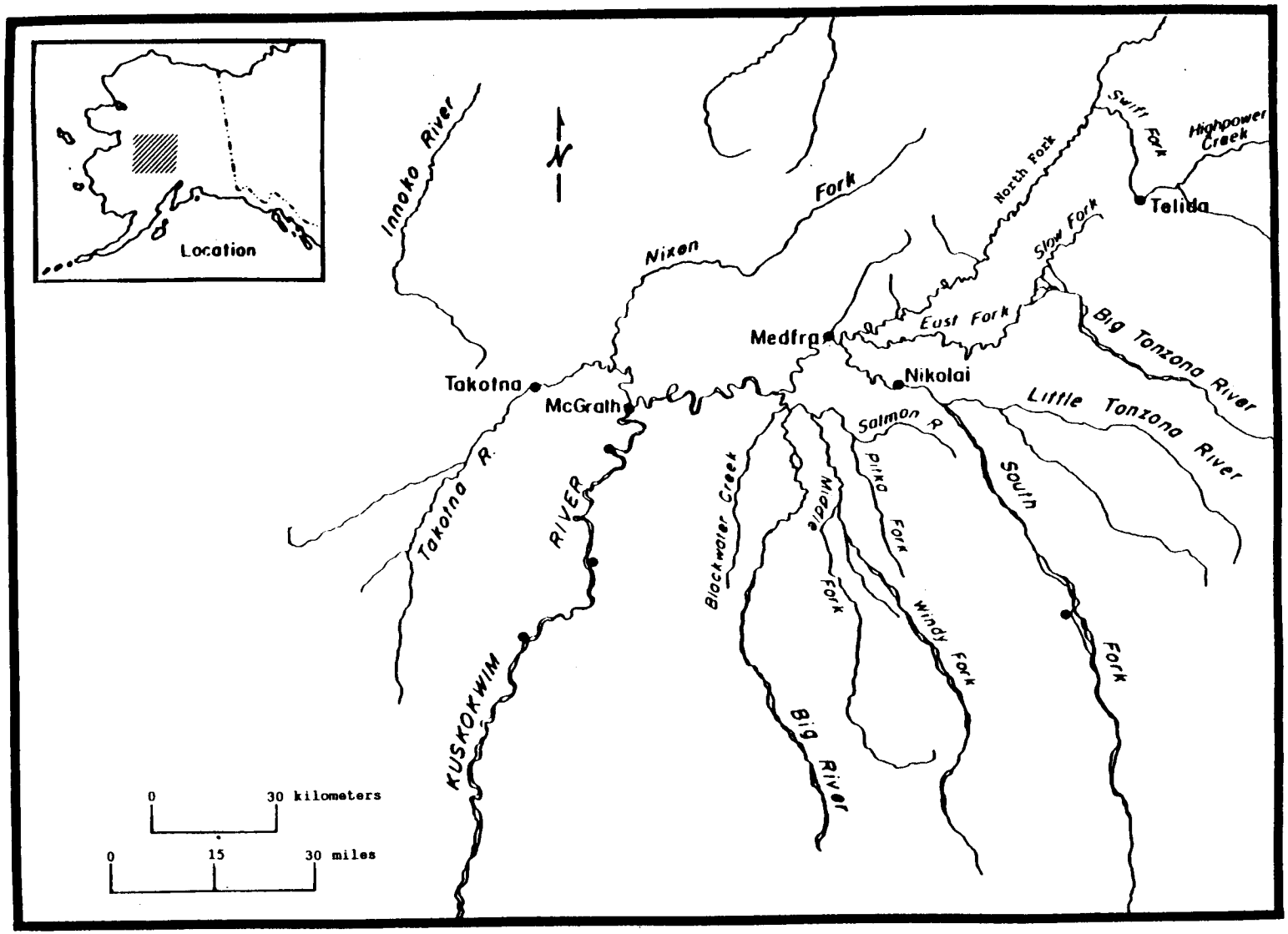


Figure 10. Waters of the upper Kuskokwim River valley.

Lake development in the Kuskokwim River drainage above the Aniak River is sparse, and there are few documented lakes with high potential for recreational fisheries. The fisheries resources in two lakes (Telequana and Two; Figure 9) in the upper Stony River were surveyed by Russell (1980), and Whitefish Lake in the upper Hoholitna River was surveyed in 1977 by Baxter (1977). Lake trout, Arctic grayling, northern pike, and various whitefish species were present in all lakes surveyed. Dolly Varden were noted in Two and Telequana lakes but not in Whitefish Lake. Recreational angling occurs in Telequana and Two lakes, both by guided and unguided fishermen. Little information is available regarding sport fishing opportunities and species available in other lakes of the drainage. Most of the lakes in the upper drainage are shallow tundra lakes, unsuitable for supporting year-round resident fish populations. Big Lake near Sleetmute, and Tundra and Trout lakes near Lime Village on the Stony River support year-round fish populations because of their size.

Clear water streams with sport fishing potential that are part of the Yukon River drainage are extremely numerous and extend to third and fourth order tributaries. Although the main stem of the river flows for approximately 3,200 km, (with the upper third in Canada) this report includes only Alaskan waters. Beginning near the Yukon River mouth, (Figure 11) the east and west forks of the Andreafsky River are both high quality sport fishing streams and have been designated as Wild and Scenic Rivers (Wild and Scenic Rivers Act 1968; ANILCA 1980). All the Pacific salmon species, with the exception of sockeye salmon *Oncorhynchus nerka*, occur in the rivers as do Arctic grayling, Dolly Varden, and northern pike (in sloughs and lakes off the rivers). Each fork of the Andreafsky River is in itself a major stream and they drain extensive remote areas of the Nulato Hills between the Yukon River Delta and Norton Sound.

The lower Yukon River provides a migratory corridor for all the species of resident, anadromous, and semi-anadromous fishes of the drainage. In addition, many species, such as sheefish, northern pike, several whitefish species, burbot and longnose suckers utilize the mainstem lower river for rearing and feeding, particularly in winter months. For some species such as burbot, the mainstem provides year-round habitat.

The Innoko River and its tributaries drain a large area of flat wetlands and foothills of the Kuskokwim Mountains. The confluence of the Innoko River with the Yukon River is near the village of Holy Cross. The Innoko River system contains numerous northern pike and whitefish as well as other species. A small sockeye salmon stock may spawn in the system, in addition to chum, chinook and coho salmon, but there is no evidence that the Innoko River is important for salmon production when compared to other known productive streams in the Yukon River drainage.

The Anvik River, which enters the Yukon River near the village of Anvik about 515 km upstream from the mouth, is a highly productive stream. The river courses eastward from its drainage area in the Nulato Hills for about 130 km and although it is primarily a rapid runoff stream, artesian upwelling helps stabilize winter flows and water temperatures. Besides supporting the largest chum salmon spawning stock in the Yukon River drainage, with over a million

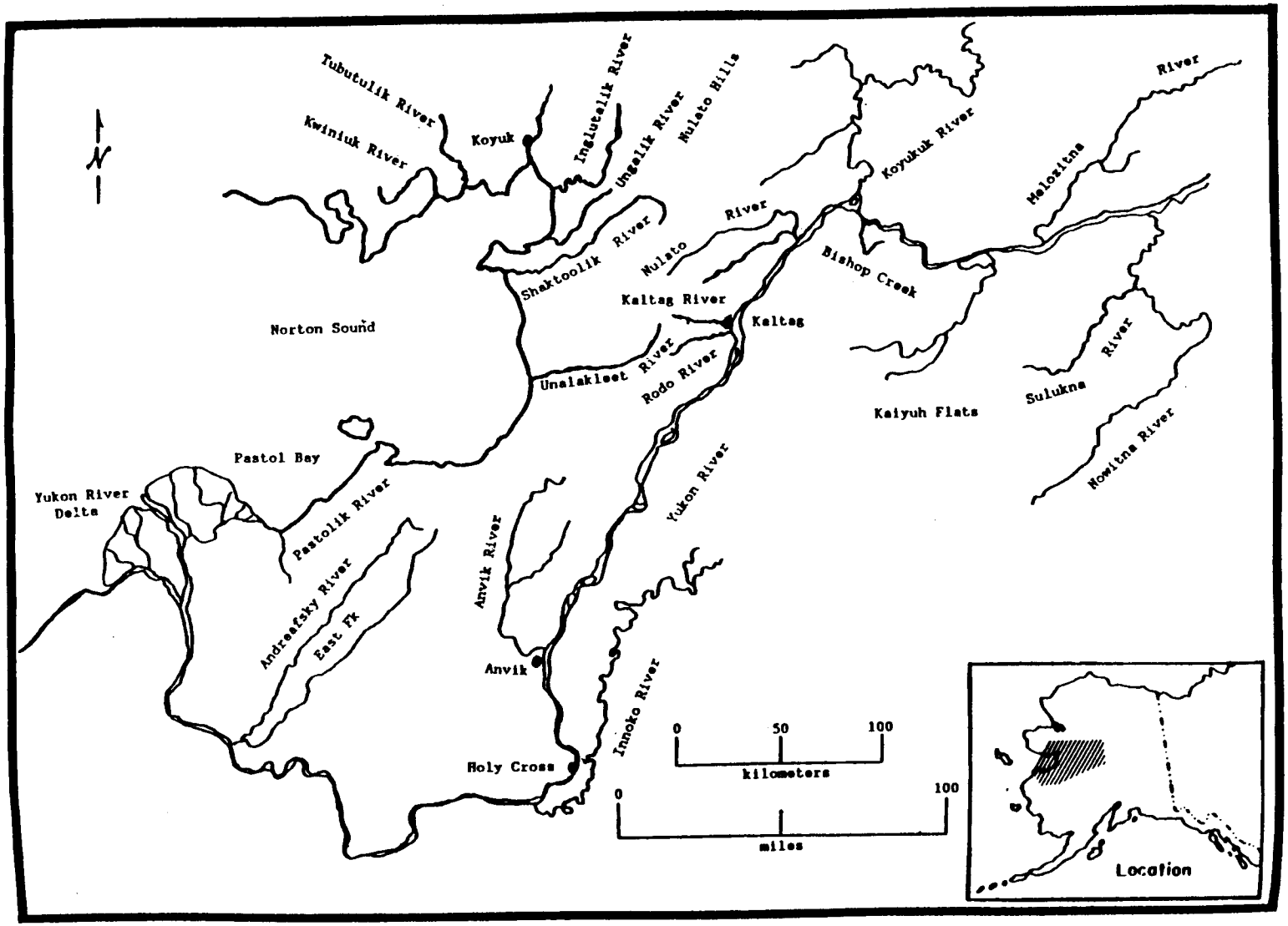


Figure 11. Lower Yukon River and eastern Norton Sound drainages.

individuals spawning in some years (Whitmore et al. 1987), the stream supports large numbers of chinook and coho salmon, Arctic grayling, Dolly Varden, and some northern pike. Fishing quality is excellent, but few anglers use the stream during the summer season because of its remoteness and difficult access.

The Kaltag and Rodo river mouths, and Bishop Creek mouth support sheefish and Arctic grayling fisheries during summer and early fall months. Sport fishing for northern pike is common in sloughs and lakes near the main stems of the Yukon and Koyukuk rivers as well as in the extensive Kaiyuh Flats southeast of Galena.

The Nowitna River, whose confluence with the Yukon River is upstream from Ruby, is a major clear tributary which enters the Yukon from the south and drains the north slope of the Kuskokwim Mountains. It was designated as a Wild and Scenic River in 1980 (Alaska National Interest Lands Conservation Act, P.L. 96-487), and supports a significant amount of recreational fishing. Most sport fishing is done by Fairbanks residents using personal riverboats or aircraft to reach the river. Good angling for sheefish, northern pike and Arctic grayling can be found in the system, which consists of several branches. Most of the main stem and major tributaries are included in the Nowitna National Wildlife Refuge (USFWS 1987b). Sheefish spawn in the Sulukna River tributary (Alt 1987).

Few lakes of sufficient area or depth to influence winter flow volume or temperature are present in the upper Kuskokwim River drainage or the Alaska Yukon River drainage. The majority of the lakes in the Yukon drainage developed as a consequence of the thawing of saturated permafrost soils and as a result, these lakes are mostly shallow and not supportive of primary sport species such as lake trout. There are thousands of such lakes in the deltas and floodplains of the drainage. Many provide summer feeding and rearing for various whitefish species, as well as for northern pike and occasionally, sheefish. Fish utilizing shallow thaw lakes for summer feeding generally move into primary tributaries and main stems of the major rivers prior to freeze-up in the fall.

Seward Peninsula/Norton Sound Sub-area:

The Seward Peninsula-Norton Sound sub-area (statewide harvest Area W; Figure 1) includes all waters north of the Yukon River drainage and south of the Selawik River-Kotzebue Sound area and west of the Yukon-Koyukuk River drainages. This area includes Pastol Bay and all salt water north and west of it in Norton Sound as well as salt water adjacent to the Seward Peninsula, including Spafarief Bay in Kotzebue Sound and the southern half of Eschscholtz Bay (ADFG 1984).

Primary sport fishing streams in eastern Norton Sound (Figure 11) include several that drain the Nulato Hills which separate Norton Sound from the Yukon and Koyukuk River valleys. They include the Unalakleet, Shaktoolik, Inglutalik, and Ungalik rivers. The Unalakleet River is the largest and most heavily utilized of these, and it supports a sport fishery during summer months. A permanent lodge is established on the lower Unalakleet River, and

guide service is available from it and other sources. The river and its tributaries support populations of Arctic grayling and Dolly Varden as well as chinook and coho salmon. Other area streams also support those species, but are not as intensively fished, primarily because of the limited access and facilities available to non-local fishermen. The Koyuk River main stem carries an abundance of entrained material, including tannic stain, reducing water clarity. The stream terminates in Norton Bay at the extreme eastern corner of Norton Sound. It offers little potential for sport fishing except for northern pike and Arctic grayling in some clear water tributaries.

Several high quality sport fishing streams are located along the southern half of the Seward Peninsula from Koyuk to Teller, (Figure 12) including the Tubutulik, Kwiniuk, Fish, Niukluk, Bonanza, Eldorado, Nome, Snake, Sinuk, Pilgrim, Agiapuk, and Kuzitrin rivers. Road access from Nome exists to many of these streams. Arctic grayling, Dolly Varden, and coho salmon occur in these streams, and many contain chinook salmon, pink salmon *Oncorhynchus gorbuscha*, chum salmon, burbot or northern pike. Small, perhaps remnant, sockeye salmon stocks are also present in the Pilgrim and Sinuk rivers. Trophy Arctic grayling, larger than 1.4 kg (3 lbs) are present in many streams on the Seward Peninsula, including the Sinuk, Nome, American, Tubutulik, Fish, Pilgrim and Kuzitrin rivers as well as others. Many of the largest Arctic grayling recorded as trophies for Alaska have been taken from streams on the Seward Peninsula. Of the 105 largest fish registered from 1967 to 1989 in the ADFG trophy fish program, 28 were taken in waters of the Seward Peninsula. Nineteen of the 28 registered trophy Arctic grayling from the Seward Peninsula were taken from the Sinuk River.

Most of the streams draining the northern half of the Seward Peninsula have low sport fishing potential due to relatively small flow volumes, difficult access, and poorer quality of water and fisheries habitat.

Most of the lakes on the Seward Peninsula were created either by thaw action in river floodplains or by glaciers in the mountains of the central and western Seward Peninsula. The largest inland body of water on the Seward Peninsula is Imuruk Lake (Figure 13) in the north-central portion of the peninsula. It is approximately 32 km^2 in area, and was probably formed when volcanic lava originating in the nearby area cut off drainage streams causing water to back up into a local depression. The lake presently drains northward through the Inmachuk River. Salmon spawn at the outlet in the fall and the lake supports whitefish and Dolly Varden.

Other lake waters with recreational fishing potential are smaller glacial lakes in the Imuruk Basin watershed and in the Kigluaik Mountains east of Nome. Some contain populations of lake resident Arctic char *Salvelinus alpinus*, (Kretsinger 1987) while other lakes and streams in this area contain anadromous Dolly Varden. Salmon Lake, located about 150 km northeast of Nome in the headwaters of the Pilgrim River, contains Dolly Varden, Arctic grayling, round whitefish and a remnant stock of sockeye salmon. Since the lake can be reached by road from the town of Nome, it receives use for sport fishing, and during the first half of the century was an important recreation and fishing area for gold miners in the area. Subsistence fishing for salmon in Salmon Lake has been prohibited for many years because the stock was

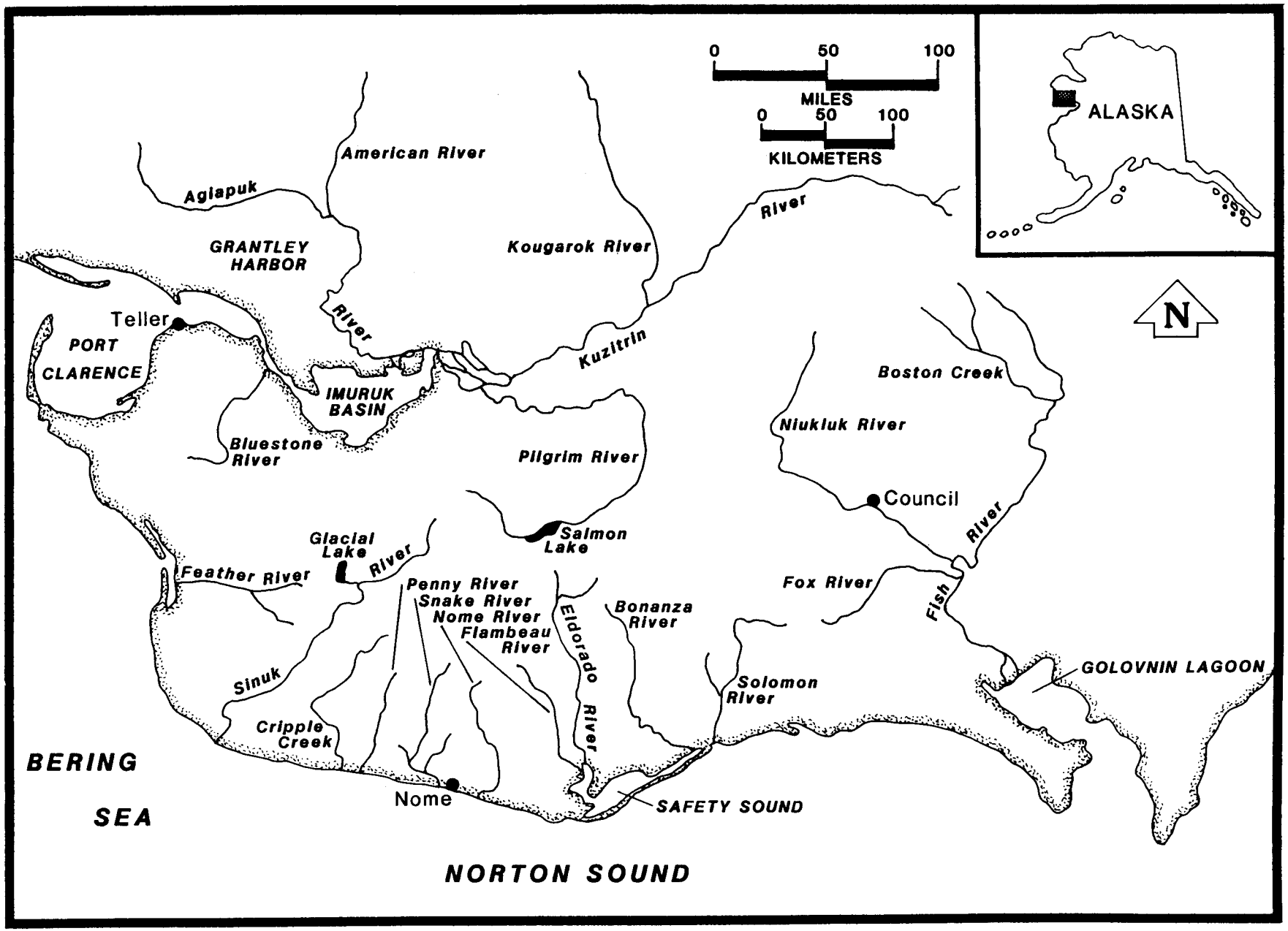


Figure 12. Waters of the Seward Peninsula.

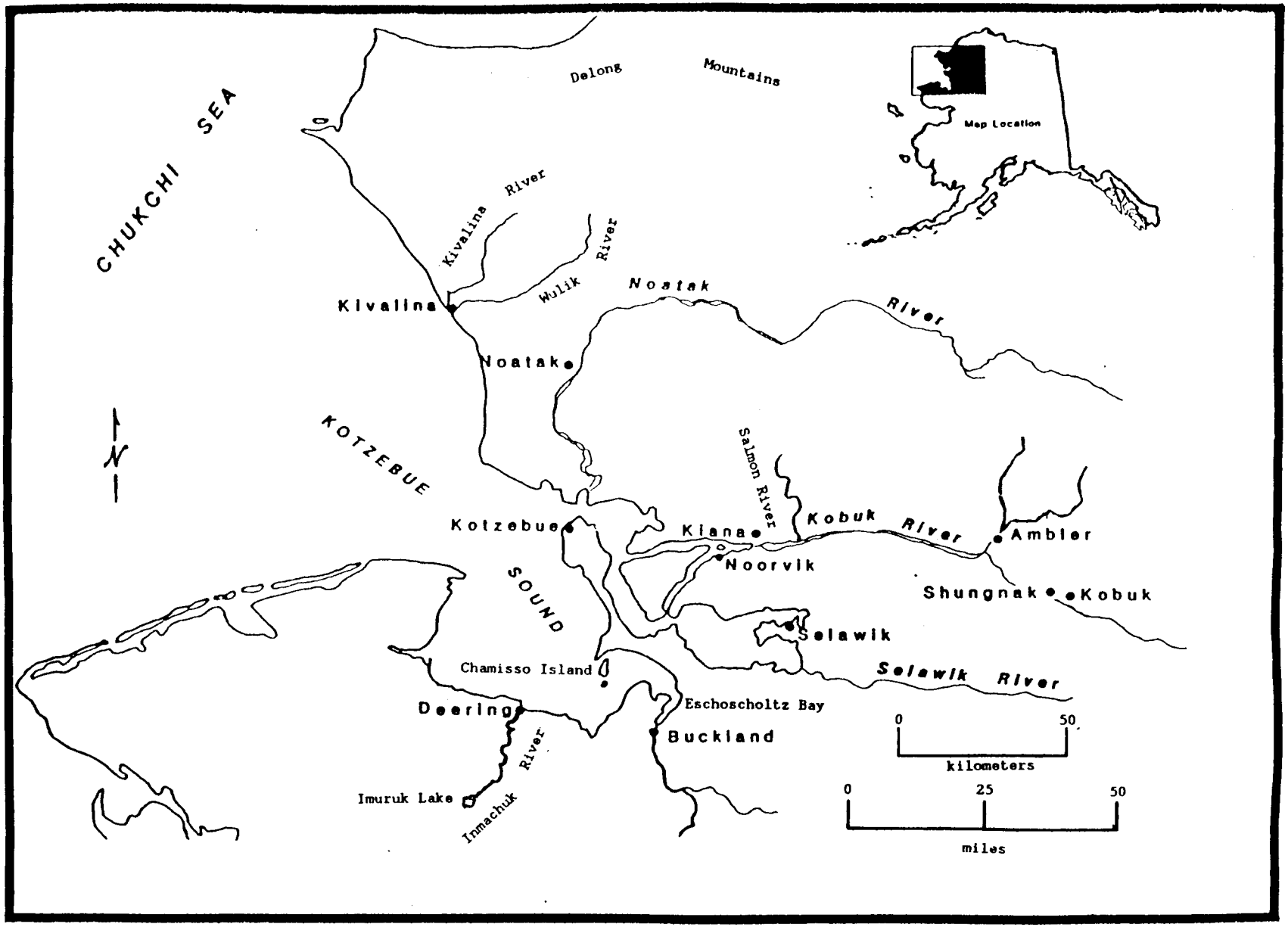


Figure 13. Kotzebue Sound and surrounding area.

practically eliminated by early fisheries. Salmon sport fishing in the lake and it's tributaries is presently prohibited.

Northwest Alaska Sub-area:

The Northwest Alaska Area (statewide harvest Area X; Figure 1) includes all waters and drainages of the Kotzebue area, including drainages of the Selawik, Kobuk, Noatak, Wulik, and Kivalina rivers. The area also includes all salt water in the northern half of Eschscholtz Bay, including the Chamisso Island area and the northern half of Kotzebue Sound to and including Point Hope (ADFG 1984). The eastward limit of the sub-area extends to the Alatna River.

The most important streams of the Northwest Alaska sub-area (Figures 13, 14 and 15) are the Noatak and Kobuk rivers, both of which drain large areas of the southern slope of the western Brooks Range. Each has a drainage area of approximately 31,000 km^2 and stream length of from 560 km (Kobuk) to 640 km (Noatak; U.S. Army Corps of Engineers 1967). The third largest drainage is that of the Selawik River, with an approximate area of 11,700 km^2. The Noatak River is slightly turbid at most times during the summer months from entrained glacial silt carried from mountain glaciers in the Brooks Range, while waters of the Kobuk and Selawik rivers are more clear. Abundant groundwater resources are found in both the Noatak and Kobuk rivers as water-bearing gravel aquifers on the lower main stem of the Noatak River and in tributaries of the Kobuk River. These aquifers tend to stabilize flows and water temperature fluctuations and provide water storage within the systems.

The Noatak River is designated as a National Wild and Scenic River, and most of the drainage is included in the Noatak National Preserve (Figure 14). The extreme upper headwaters of both the Noatak and Kobuk rivers are included in the Gates of the Arctic National Park. A part of the lower Kobuk Valley between Kiana and Ambler is included in the Kobuk National Park, and the Salmon River tributary, as well as the upper main stem of the Kobuk River are National Wild and Scenic Rivers as is the Selawik River. Much of the Selawik River valley is part of the Selawik National Preserve.

These three large river systems contain abundant fisheries resources. The Noatak River produces a large run of late chum salmon that are the primary species for the Kotzebue-based commercial fishery. Many thousands of anadromous Dolly Varden overwinter and spawn in the river. Whitefish and northern pike are resident in the Noatak River. Alt (1987) reports that sheefish use the river for feeding but do not spawn there.

Both the Selawik and Kobuk rivers support spawning populations of sheefish in their upper main stems. The brackish delta systems which have formed at the river mouths serve as overwinter feeding areas for juvenile as well as adult sheefish. Trophy sheefish are taken from these waters especially in the upper Kobuk River during the fall when large mature spawners congregate near spawning areas in the main stem. The Alaska state record sheefish was taken in 1986 from the upper Kobuk River (mouth of the Pah River) and weighed 24 kg (53 lbs). Abundant whitefish utilize the rivers and delta areas, including Selawik Lake and Hotham Inlet (Kobuk Lake). Dolly Varden occur in some tributaries to the Kobuk River, as do northern pike in sloughs and connecting

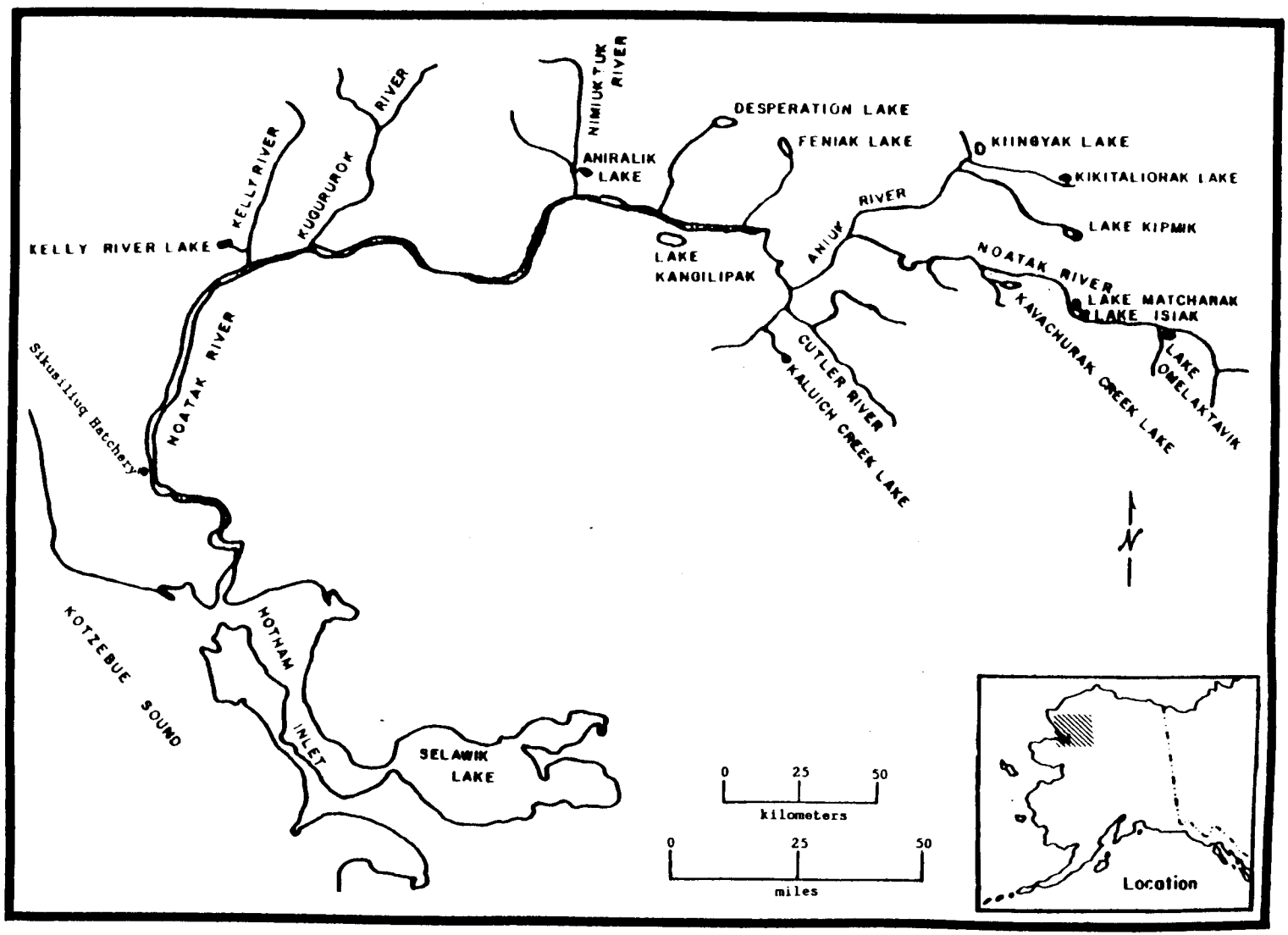


Figure 14. Waters of the Noatak River.

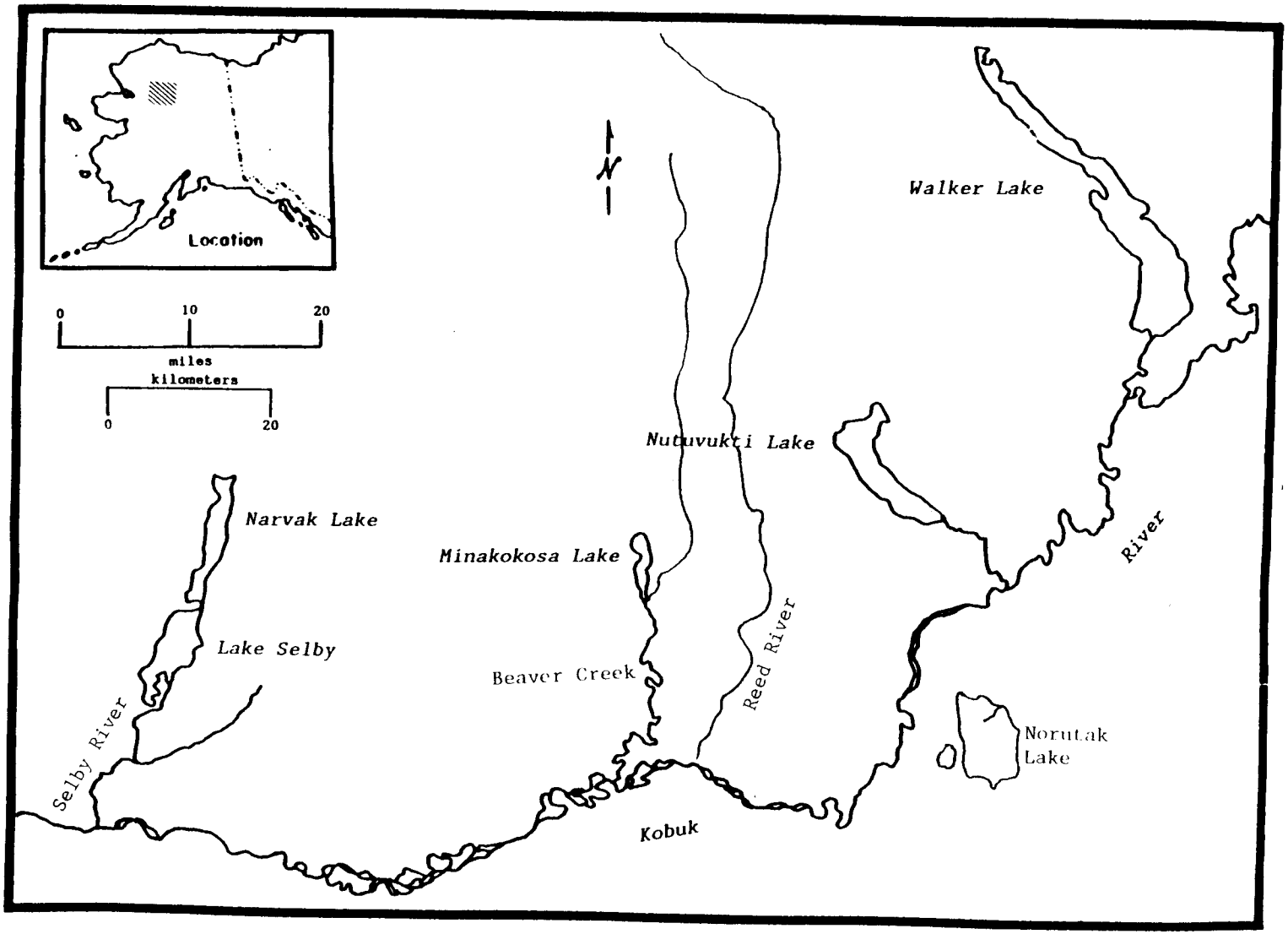


Figure 15. Waters of the upper Kobuk River.

lakes to the lower river. Lake trout inhabit deeper lakes of the upper Kobuk River watershed. The Wulik and Kivalina rivers, which empty into the Chukchi Sea near the village of Kivalina, are well known as trophy streams for Dolly Varden.

Sport fishing effort in Northwest Alaska is relatively light compared to most other areas in the state. Heaviest use occurs on the Noatak, Kobuk, and Wulik rivers. Many visitors to Gates of the Arctic National Park and Kobuk Valley National Park participate in float trips on the Kobuk River from Walker Lake to Kobuk village (Alt 1984; ADFG 1986; NPS 1984, 1985a). A lodge on Walker Lake promotes lake trout and Arctic char fishing. A small amount of shore fishing with hook and line for sheefish takes place near Kotzebue in the summer.

Guided and unguided anglers and river floaters use the Noatak River as do Kotzebue area residents who boat to different parts of the river to fish. The most popular fishing area is the Kelly River, but other tributaries such as the Nimiuktuk and Kugururok rivers are also used occasionally primarily for Dolly Varden fishing (Alt 1978).

Raft, canoe, and kayak trips are increasingly popular recreational uses on the Noatak River. Many parties put in at Matcharak Lake (Figure 14) and portage to the river, or land wheel aircraft on gravel bars farther upstream. Arctic grayling, Dolly Varden and lake trout are available in the upper Noatak River, but downstream from the Nimiuktuk River, chum salmon and northern pike also occur. Lake trout occur in Matcharak, Feniak, and Desperation lakes and in other lakes in the middle and upper Noatak drainage. Most lakes in the area are accessible only by floatplane.

The lower floodplains of the Kobuk and Selawik rivers, especially in the vicinity of the Kobuk River delta, and the lower Noatak River (upstream of the lower canyon of the Noatak) contain hundreds of shallow thaw lakes of various sizes. Fisheries resources of the waters in this area are poorly inventoried, but large populations of whitefishes, northern pike, and sheefish are known to be seasonally present. The mountains in the upper Kobuk River drainage (Figure 15) contain several relatively large, deep lakes which were formed by glacial action. Lake trout, Arctic grayling, Arctic char and perhaps one or two whitefish species inhabit these lakes. They include Walker Lake, Nutuvukti Lake, Minakokosa Lake, Lake Selby and Narvak Lake.

Lakes of the upper Noatak River (Figure 14) were surveyed by Alt (1978), with a brief inventory of 13 lakes in the upper drainage. Fish were present in all lakes surveyed, and round whitefish lake trout and Arctic grayling were the most common species. Least cisco, northern pike, Dolly Varden, slimy sculpin *Cottus cognatus*, salmon (chum and sockeye), and ninespine stickleback *Pungitius pungitius* were also found.

South Slope Brooks Range Sub-area:

The south slope of the Brooks Range sub-area (statewide harvest Area Y; Figure 1) includes all drainages south of the Brooks Range, west of and including the Koyukuk and Alatna River drainages, and north of the Yukon River, including

all northern tributaries of the Yukon River from Kaltag to the Canadian border.

A major portion of the south slope Brooks Range sub-area is contained within the boundaries of the Gates of the Arctic National Park and Preserve. Most of the streams in the sub-area drain to the south from the Brooks Range into the Porcupine Koyukuk, and Yukon rivers (Figures 16, 17, 18, and 19). Significant flowing waters include the Alatna River, and other Koyukuk River tributaries such as the Gisasa, Kateel, Dulbi, Huslia, Indian, Kanuti, Hogatza, Dakli, Henshaw, John, Wild, North Fork, Tinayguk, South Fork, Middle Fork, and Jim rivers. To the east are the Dall, Hodzana and Hadweenzic rivers, the Chandalar River with several tributaries and forks, the Christian River, and the lower Porcupine River with tributaries such as the Sheenjek, Coleen, Black, and Little Black rivers. The Dalton Highway (North Slope Haul Road) bisects the sub-area in a north-south direction (Figure 17), and provides access for recreational fishermen to several streams of the area, including the Ray River, the Middle Fork and South Fork of the Koyukuk River, as well as Prospect Creek and Jim River of the upper Koyukuk River system.

The Nulato River enters the Yukon River near Nulato, about 775 km from the mouth of the Yukon River. Smaller and more difficult to navigate than the Anvik River, the stream nevertheless has sport fishing potential for salmon, Arctic grayling, Dolly Varden and northern pike. The stream receives some seasonal sport fishing use at the present time from anglers stationed at a U.S. Air Force station in Galena.

The mouth of the Melozitna River supports fisheries for sheefish and Arctic grayling during summer and early fall. Geothermal hot springs occur on one of the creeks of the Melozitna River, and a permanent lodge there caters to hunters and fishermen. The Melozitna River is also utilized frequently by local fishermen for Arctic grayling, particularly in the lower 16 km below rapids which effectively isolate the upper reaches of this stream.

The Koyukuk River, one of the largest first order tributaries of the Yukon, enters the Yukon River downstream from Galena, about 820 km from the mouth (Figures 16 and 17). The main stem of the Koyukuk is turbid in its lower reaches from tannic stain, bank erosion and leaching. Lower Koyukuk River tributaries such as the Gisasa, Kateel, Dulbi, and Indian rivers are not well known outside of the local area but seasonally provide good sport fishing opportunities. Sheefish are taken at the mouths of several streams including the Kateel and Dulbi rivers and where John Junior Slough meets the Koyukuk River about 32 km upstream from the mouth. Arctic grayling are common in clear tributary streams and local residents of nearby villages as well as military personnel stationed at the Galena Air Station fish for them. Sport fishing for northern pike takes place commonly in sloughs and lakes near the main stems of the Yukon and Koyukuk rivers as well as in the extensive Kaiyuh Flats southeast of Galena. Since sheefish spawn in the main stem of the Koyukuk River near Hughes, there are both immature and adult mature prespawning individuals present in the lower Koyukuk River throughout the summer prior to the September spawning period (Alt 1987).

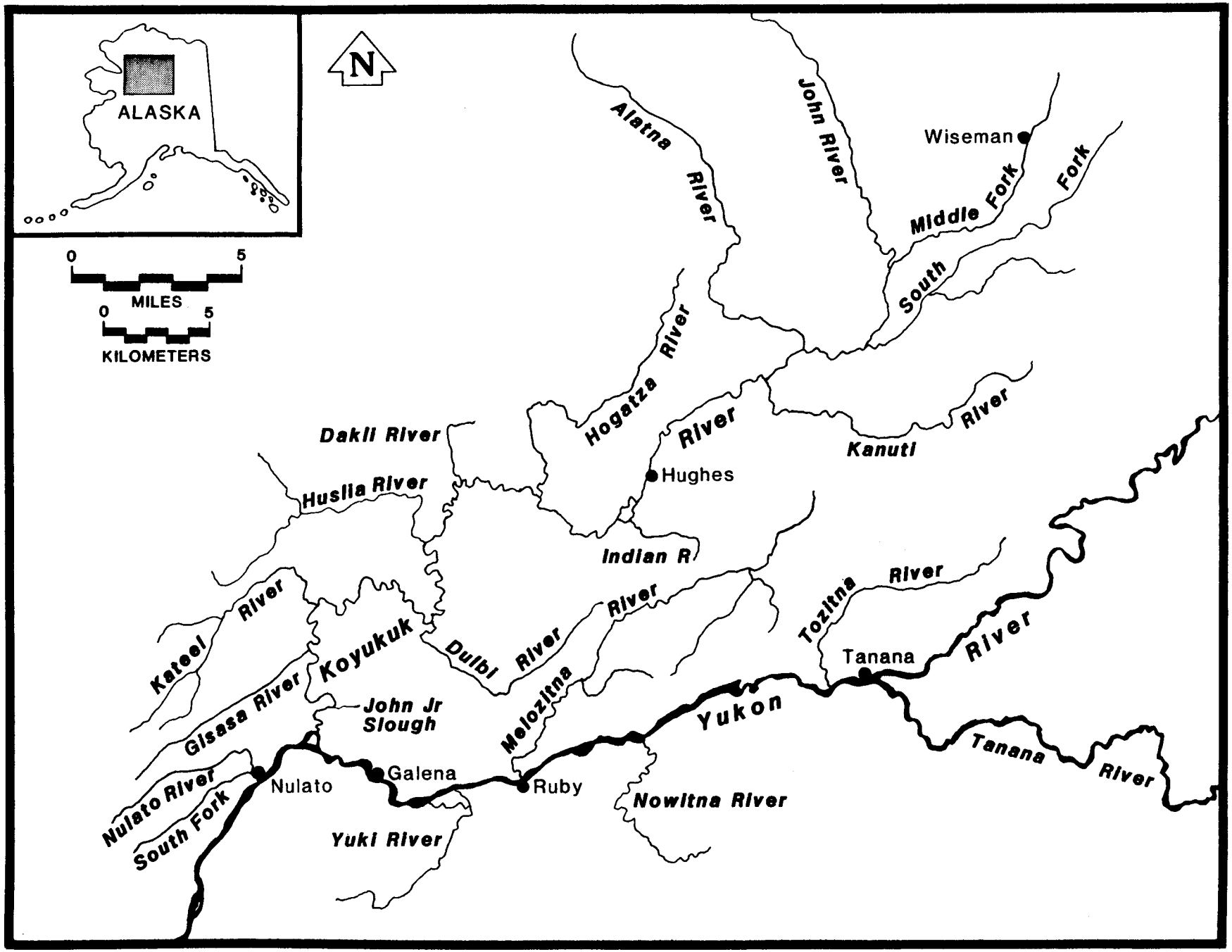


Figure 16. Middle Yukon River and Koyukuk River drainages.

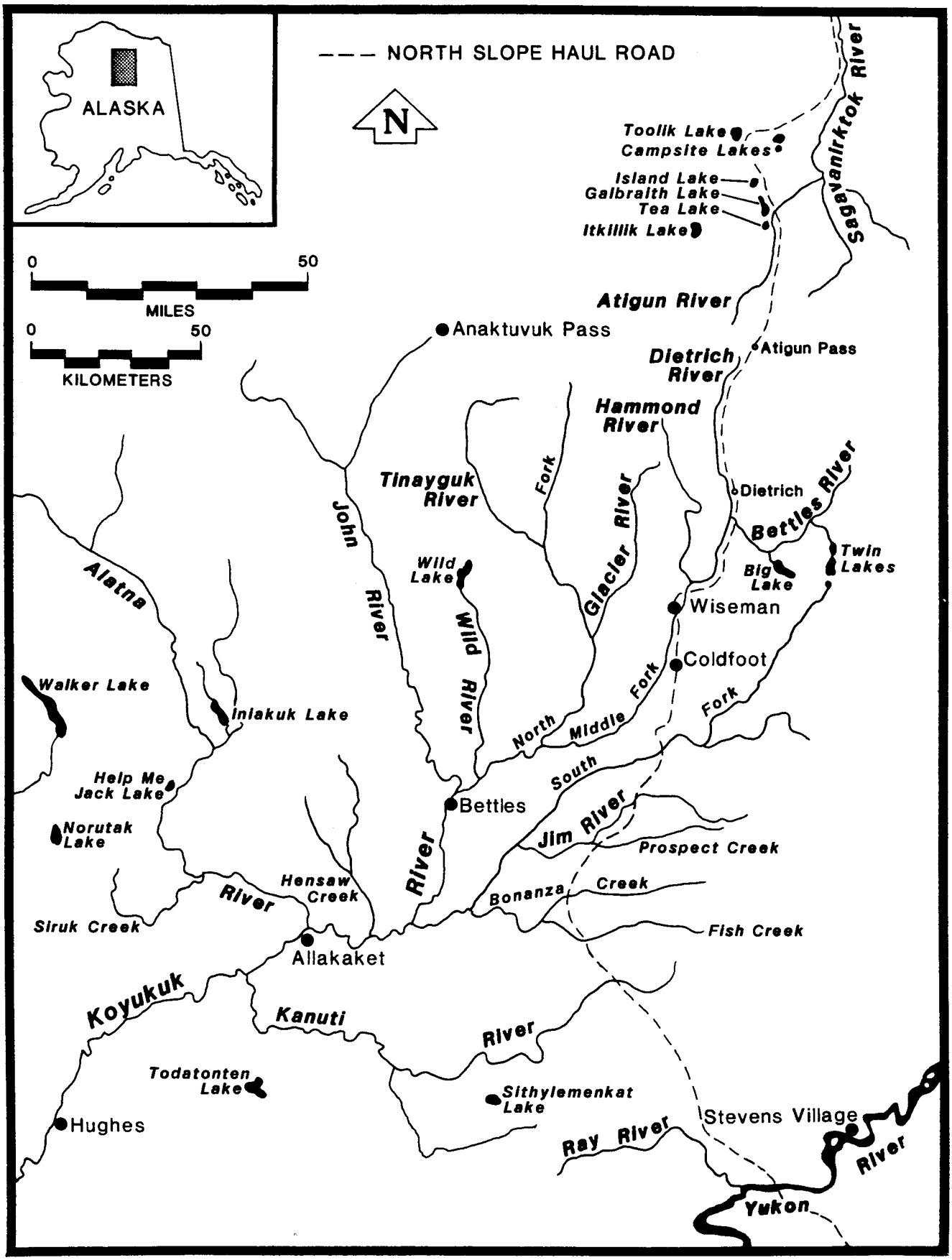


Figure 17. Upper Koyukuk River and North Slope Haul Road.

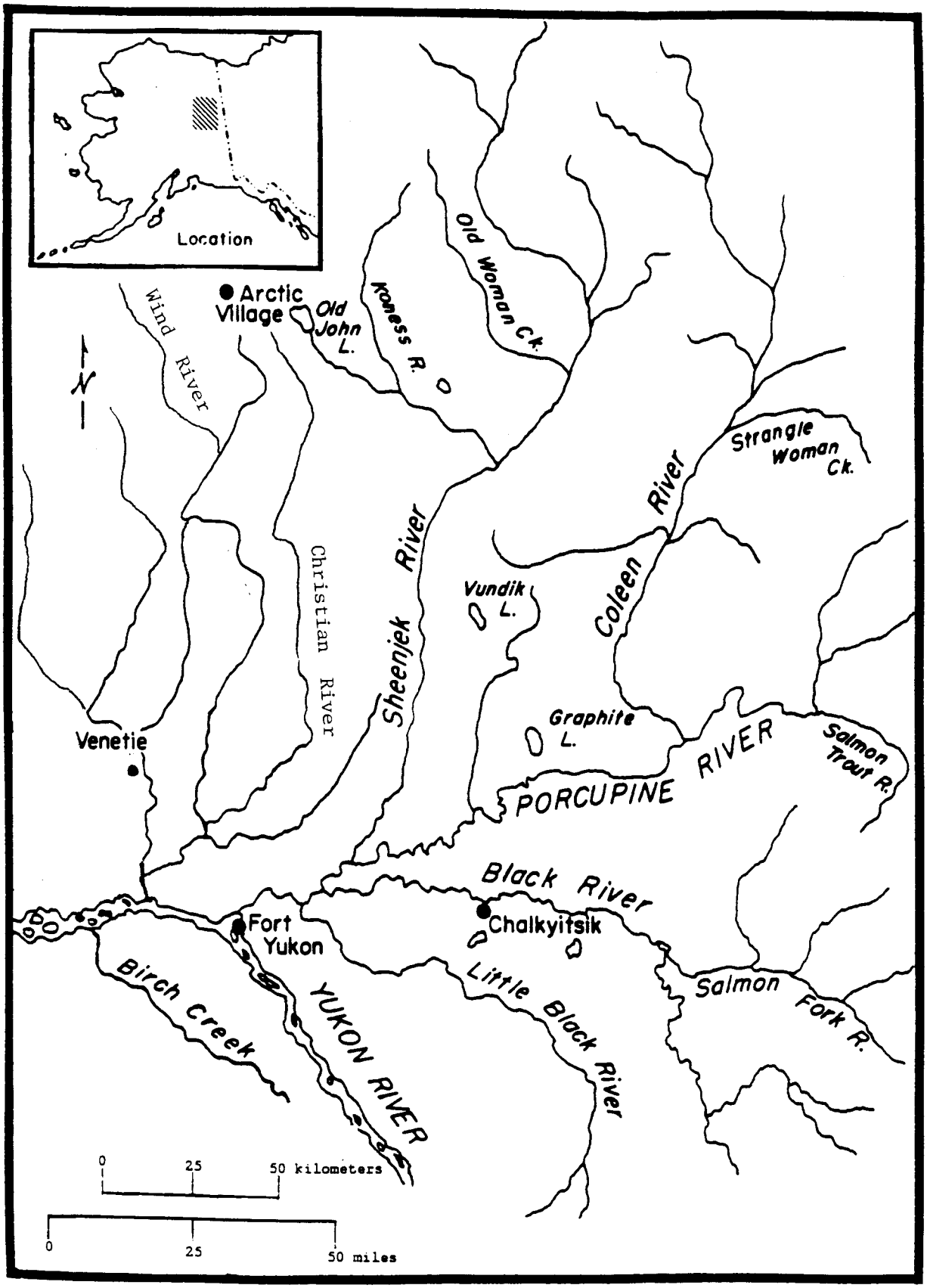


Figure 18. Porcupine River drainage.

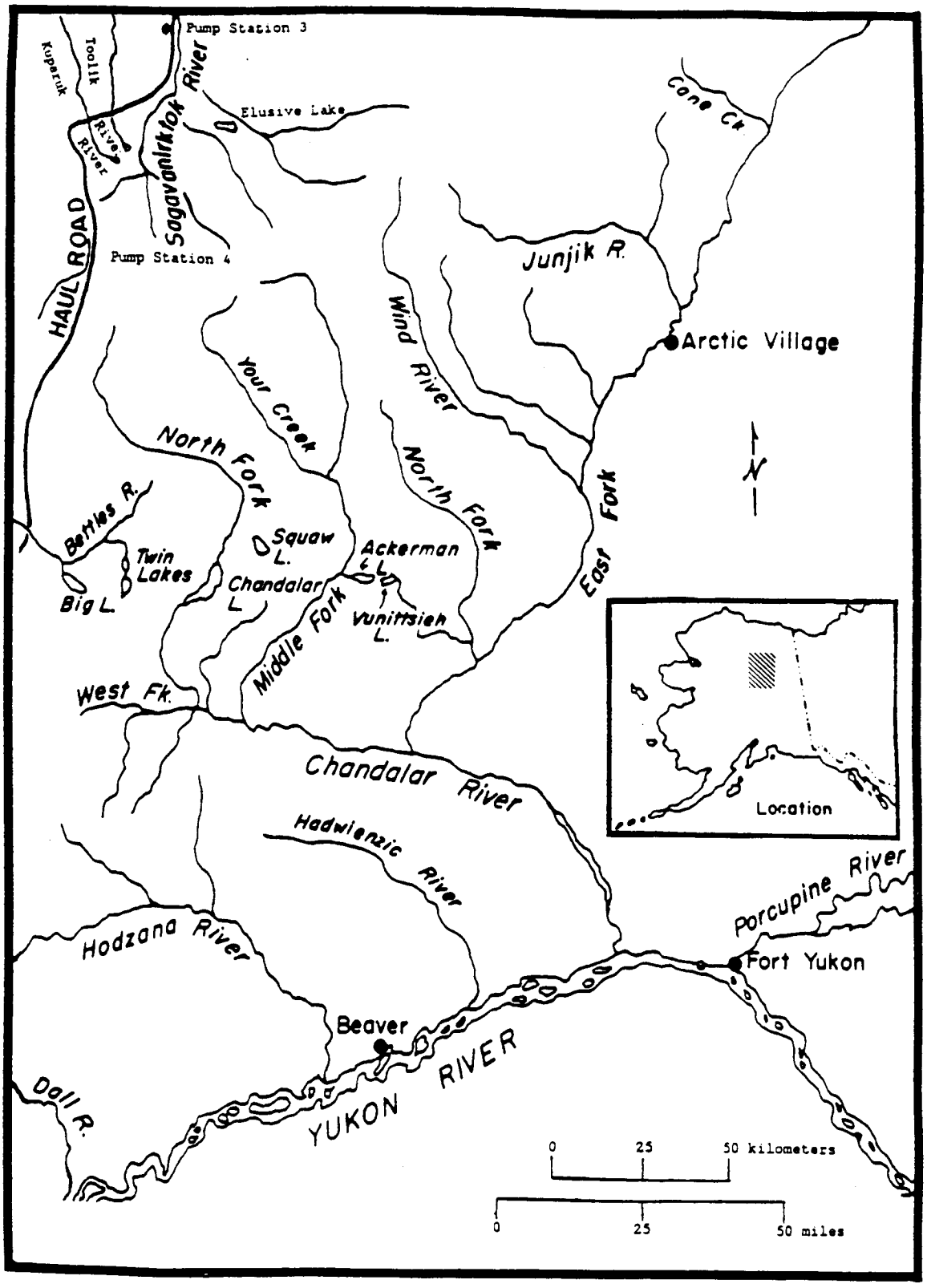


Figure 19. Chandalar River system.

Other Yukon River tributaries below the Porcupine River confluence that support sport fishing include the Tozitna River, Ray River, Dall River, Hodzana River, Hadweenzic River, Chandalar River (Figures 7 and 19), and Christian River (Figure 18). Upper Koyukuk River tributaries that cross the Dalton Highway (North Slope Haul Road) are illustrated in Figure 17.

The Yukon Flats is an extensive wilderness wetland between Circle and Stevens Village below the confluence of the Porcupine River. Portions of the Yukon Flats that are located north of the Yukon River are included with the South Slope Brooks Range sub-area. Thousands of shallow thaw lakes have developed throughout the flats. Many of the lakes support fish populations, at least seasonally, especially those with occasional connections to the sloughs and streams in the area. Northern pike and whitefish species are most common to this area, but sheefish and Arctic grayling also occur in some waterways (USFWS 1985). Salmon production is very limited in the Yukon Flats proper. The area between Beaver Village and Fort Yukon on the Yukon River main stem is known to support sheefish spawning (Alt 1987). This sub-area contains approximately half of the Yukon Flats National Wildlife Refuge, (Figures 19 and 20) and there are literally thousands of lakes present of various sizes and origins. The lakes of the area are categorized roughly (USFWS 1985) into: (1) foothill lakes (formed from streams, with sufficient depth for fish habitation); (2) tundra lakes (which are shallow and often freeze to the bottom); and (3) lowland lakes of three types: oxbow lakes with river connections and deep enough to support fish, mud lakes (shallow, and suitable only for fish rearing), and lakes created from beaver activity. There is currently little documentation available on resident fishes that utilize these vast wetlands. The U.S. Fish and Wildlife Service is conducting inventories and lake surveys in the waters of the Yukon Flats Refuge to provide information on this subject.

The Porcupine River (Figure 18) is the largest Yukon River tributary, draining an immense area of the eastern Brooks Range through the Sheenjek and Coleen rivers, the British Mountains through the Old Crow River, the Richardson Mountains in Canada through the Bell, Eagle, and Rock rivers, and the northern Ogilvie Mountains in north-central Yukon Territories through the East Porcupine Fork and its tributaries. The Black River which drains the southeastern slopes of the Ogilvie Mountains is one of it's major Alaskan tributaries. The Little Black River drains a lowland area south of the Black River parallel to the main stem of the Yukon River.

Other major tributaries between Fort Yukon and the Canadian border are all above Circle City, and include the Charley, Seventymile, and Fortymile rivers on the south side of the Yukon River (Tanana Area) and the Nation, Kandik, and Tatonduk rivers entering the north side (South Slope Brooks Range sub-area) of the Yukon River (Figure 8). Parts of Birch and Beaver creeks as well as parts of the Charley and Fortymile rivers are designated as National Wild and Scenic Rivers (Appendix A). The major species for sport fishing on the rivers upstream of Fort Yukon are Arctic grayling in the upper stream reaches and northern pike in the lower slower sections.

Several large mountain lakes are present. They include Iniakuk, Wild, Big, Twin, Chandalar, Ackerman, and Old John lakes (Figures 17, 18 and 19). All

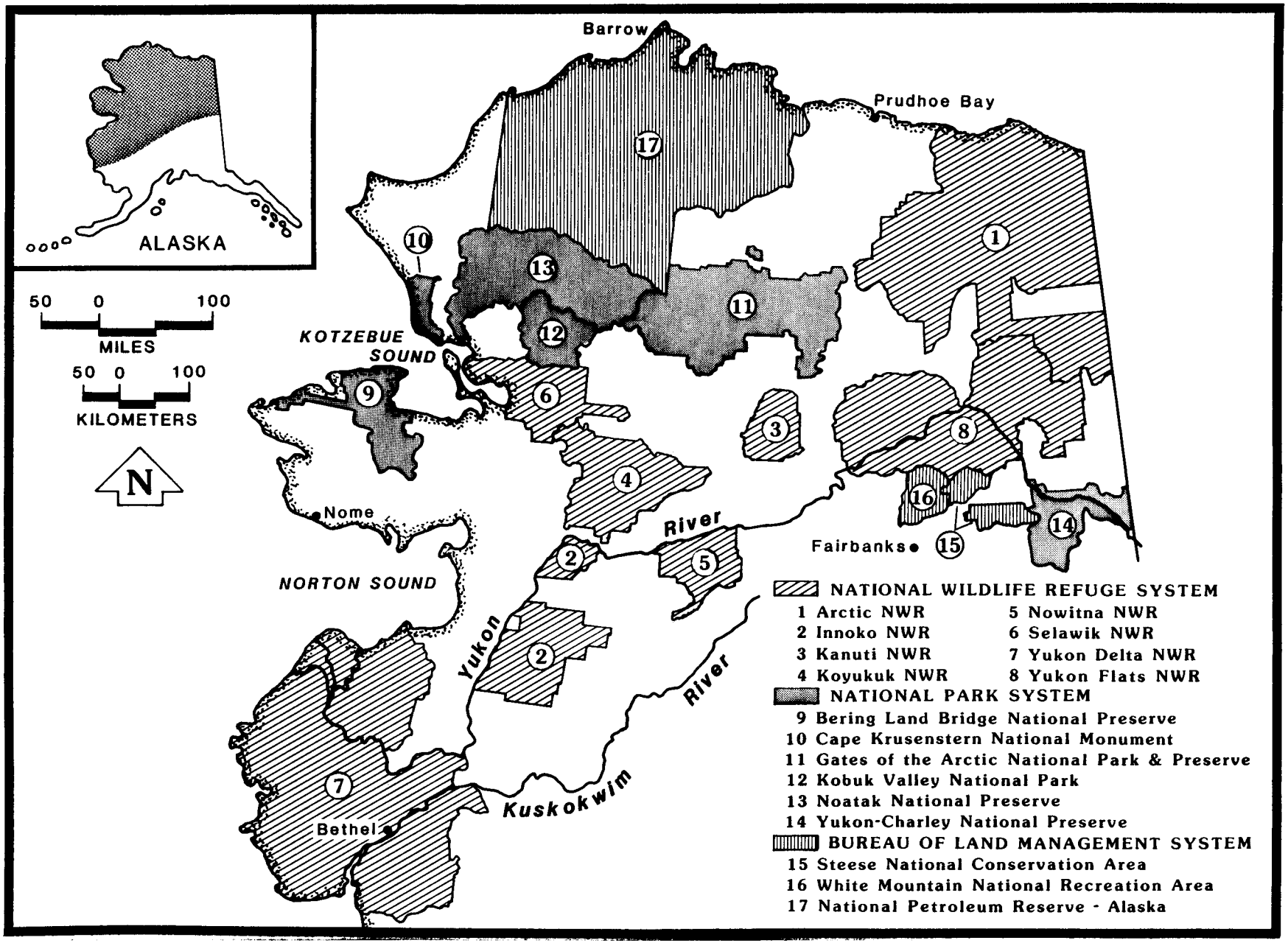


Figure 20. Federal land designations within the A-Y-K region.

are believed to contain lake trout populations as well as Arctic grayling and other species of whitefish and cisco in most cases.

North Slope Brooks Range Sub-area:

The north slope of the Brooks Range sub-area (statewide harvest Area Z; Figure 1) includes all waters north of the Brooks Range divide flowing into the Beaufort and Chukchi Seas from Point Hope on the west to the Canadian border on the east including adjacent saltwater areas.

The northern-most part of Alaska is characterized by its broad Arctic coastal plain, which abuts the Arctic Ocean and Beaufort Sea, and by the foothills and mountains which form the Brooks Range (Figure 21). The central and eastern Brooks Range consist of rugged, glaciered, east-trending ridges with summits rising to elevations of 4,350 to 5,000 m. The Delong Mountains on the western flank of the Brooks Range consist of glaciered ridges, 1,865 to 2,500 m in elevation, which drain northward into the Chukchi Sea. Only a few small lakes and no glaciers exist in the Delong Mountains although they were glaciered during the ice age. From the central and eastern Brooks Range, the mountain rivers flow northward to the Beaufort Sea. As Selkregg (1976) points out, although several large rock basin lakes lie at the mouths of glaciered valleys on both sides of the range, there are surprisingly few lakes for a glaciered area. Although most of the streams that cross the foothills flow northward from their sources in the range, the region's largest stream, the Colville River flows eastward for more than 320 km before turning north onto the coastal plain (Figures 21 and 22). The drainage area of the Colville River is about 62,000 km^2, a little more than half of the area drained by the Tanana River. Most streams east of the Colville River are braided and cross broad gravel flats that are often blocked in winter by aufeis (fields of ice that form continuously downstream from spring water sources) that cause local flooding (Selkregg 1976). The upper valleys of major rivers flowing from the Brooks Range often contain morainal lakes.

The coastal plain is an area of low relief and poor drainage due to underlying permafrost and a shallow active layer, factors that lead to moisture entrapment near the surface. Rivers that cross the plain originate in the hills or mountains to the south. In the west, more than half of the plain is covered by oriented thaw lakes aligned to the north-northwest on their long axes. Ice-wedge polygons are found throughout the coastal plain section.

Major flowing waters of the coastal plain from west to east, include the Kukpowruk, Utukok, Kuk, Meade, and Itpikpuk rivers (Figure 21). The Colville River has several major tributaries, including the Killik, Chandler, Anaktuvuk, and Itkillik rivers (Figure 22). Streams east of the Colville River include the Kuparuk, Sagavanirktok (Figure 23), Canning, Hulahula, and Kongakut rivers (Figure 21).

The North Slope is accessible by air travel or by driving the Dalton Highway north from Fairbanks. The highway was originally built in 1974 to support construction of the Trans-Alaska oil pipeline. Sport fishing was closed for 8 km (5 miles) on either side of the pipeline beginning in 1978 to prevent rapid fisheries depletion by construction workers along the Trans-Alaska Pipeline.

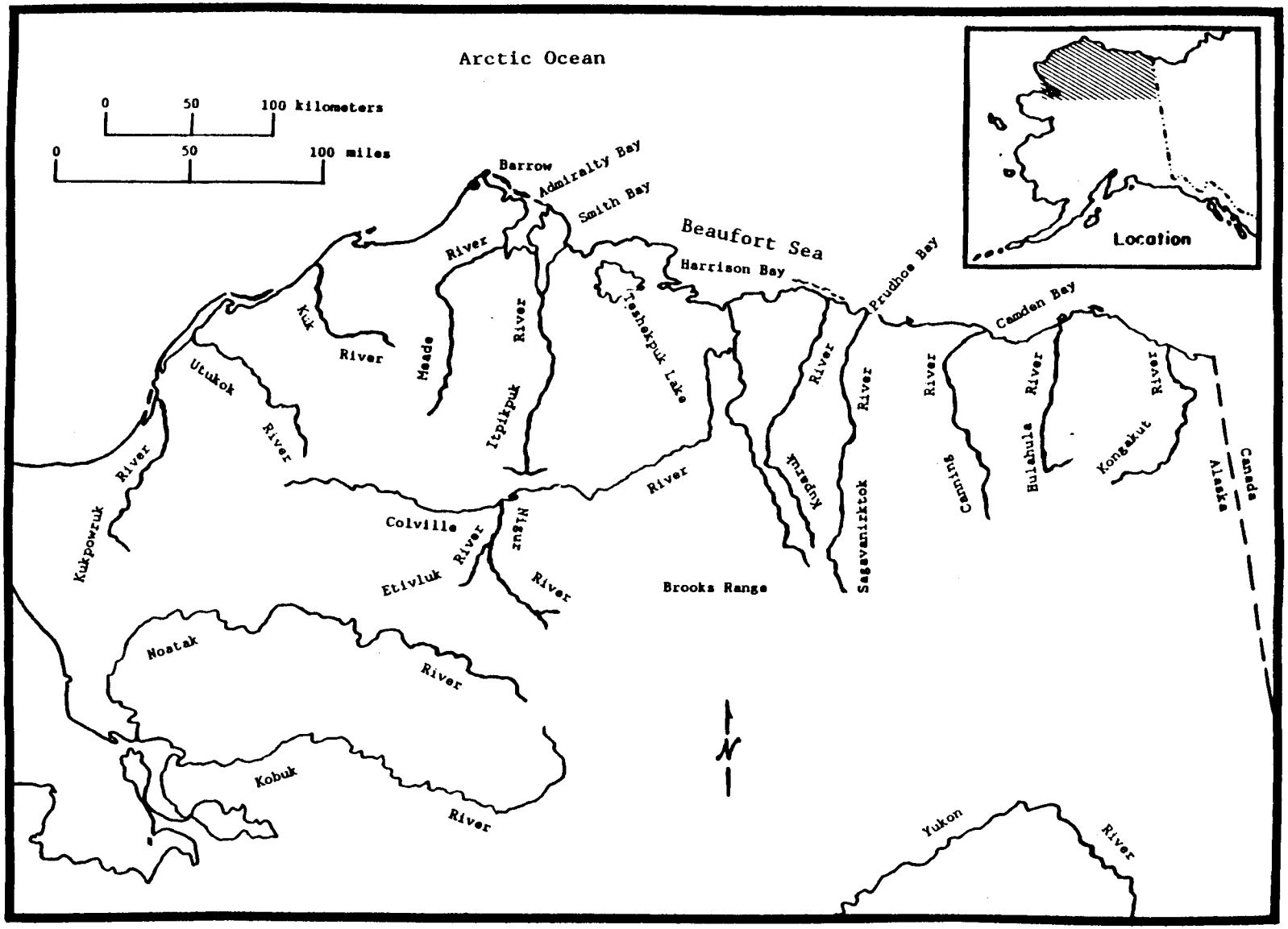


Figure 21. Waters of the Arctic Slope.

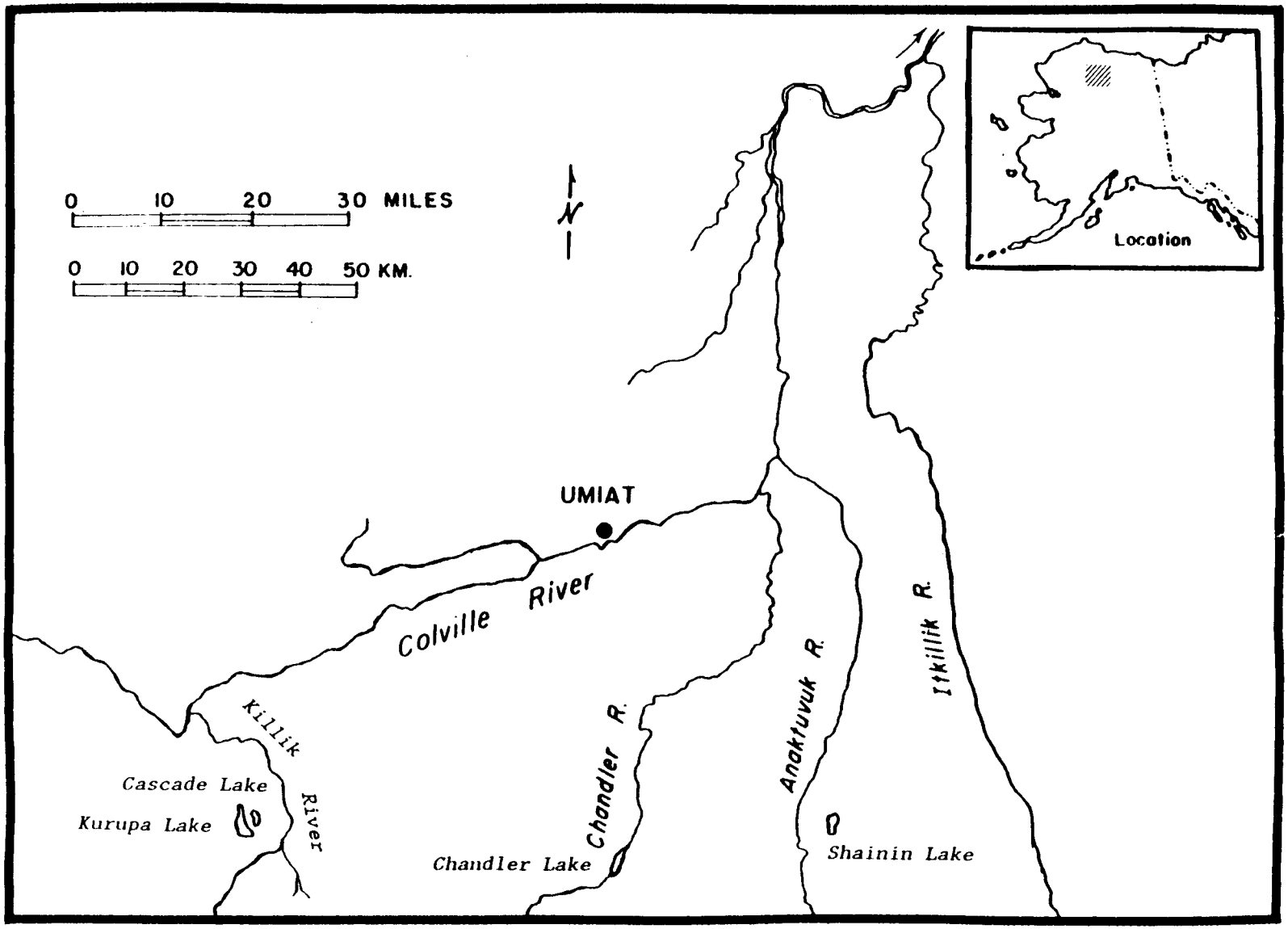


Figure 22. Principal tributaries of the Colville River.

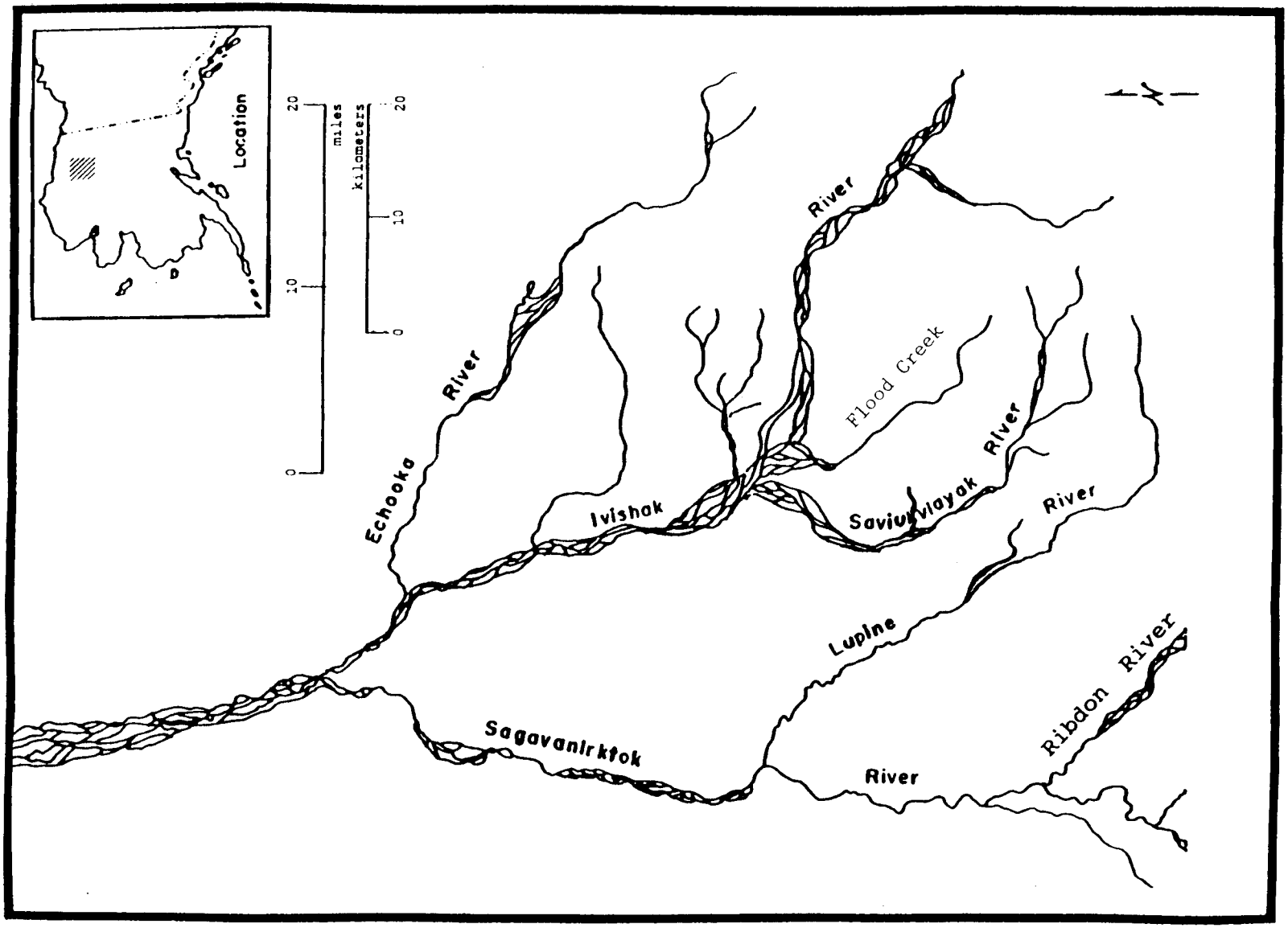


Figure 23. Principal tributaries of the Sagavanirktok River.

The closure was rescinded in 1980 by the Alaska Board of Fisheries when the Haul Road Corridor was opened for fishing for all species except sheefish and salmon (Bendock 1980). Since June 1981, the highway south of Disaster Creek (near Dietrich, Figure 17) has been open to travel by the general public (Bendock 1982). The Alaska Board of Fisheries opened the Haul Road Corridor for sheefish fishing in 1987, but salmon fishing remains closed.

The Dalton Highway crosses tributaries of the Sagavanirktok, Toolik, and Kuparuk rivers and parallels the Sagavanirktok River for about 160 km (100 miles) south of Prudhoe Bay, providing access to sportfishing opportunities for Arctic grayling, lake trout, Dolly Varden and Arctic char (Figure 17). There are numerous small lakes between Ribdon River (tributary to the Sagavanirktok River) and Galbraith Lake that provide good fishing opportunities for these species (Figure 23).

Light sportfishing effort also takes place on the Colville, Kongakut, Canning, Ivishak, Echooka, Killik, and Anaktuvuk rivers, as well as the Hula Hula River (ADFG 1986). Some fishing may also be done by parties floating the Nigu and Etivluk rivers (Bendock 1983). A significant proportion of the sportfishing in this sub-area is by persons engaged in hunting activities as their main pursuit.

Lakes such as Toolik Lake in the upper Kuparuk River and Galbraith Lake in the upper Sagavanirktok River are two of the most frequently fished lakes north of Atigun Pass (Bendock and Burr 1984). Other popular lakes along the Haul Road include Island, Campsite, and Tea lakes. Lakes outside the Dalton Highway Corridor that receive sportfishing effort include Elusive, Shainin, Itkillik, Cascade, Kurupa, and Chandler lakes (Figures 19 and 22; Furniss 1974; NPS 1985a).

AYK Area Climate

Because of geographic and topographic diversity and size, annual climatic parameters vary considerably throughout the area. Except for the immediate coastal areas, a continental type of climate prevails over much of the AYK Area, with warm summers, cold winters and little precipitation. Annual precipitation is usually sparse except for the areas under coastal influence. In lower latitudes, the amount of precipitation generally received in the AYK Area would result in arid conditions similar to those found in many deserts of the world. Because of cooler temperatures in Alaska, and the fact that a great deal of moisture is trapped in permafrost soils, desertification has not occurred, and, in fact, much of the area gives the appearance of having received abundant moisture. Typical summer weather lasts from mid-June until late August or early September, with rainy weather typical during August and September. Snowfall is usually light even in the coastal areas of the AYK Area, as compared to other areas of the state.

Species of Importance to the Sport Fishery

In addition to the species listed for the Tanana Area, Dolly Varden and Arctic char are important to sport fishing in many waters of the AYK Area. Wild stocks of rainbow trout occur as far upstream in the Kuskokwim River drainage

as the Aniak River and its tributaries. Rainbow trout do not occur naturally north of the Kuskokwim River, although they have been stocked in two lakes of the AYK Area. Pink salmon are an important sport fish species in the Norton Sound and Seward Peninsula sub-area where there is sport fishing effort in both freshwater and marine waters. Additional species of whitefish that are of importance to fisheries in the AYK Area include the broad whitefish, *Coregonus nasus*, Arctic cisco, *Coregonus autumnalis*, and Bering cisco, *Coregonus laurettae*. All other species listed under the Tanana Area are also found in the AYK Area.

AYK Area Sport Fisheries

A brief description of AYK Area sport fisheries follows.

Chinook Salmon:

Chinook salmon spawn throughout the Kuskokwim and Yukon River drainages and in streams of eastern Norton Sound and the southern Seward Peninsula. Chinook salmon occur in streams north of the Seward Peninsula, but no stocks identified are sufficiently abundant to support commercial or sport fisheries. Concentrated sport fishing occurs in only a few streams in the AYK Area, and the majority of the sport harvest is taken by local residents. More intensive sport fishing occurs in Norton Sound on the Unalakleet River and on the Seward Peninsula in parts of the Fish River system where commercial guiding and lodging facilities have been developed to promote sport fishing for salmon. Guided fishing for chinook salmon also takes place on the Holitna River in the Kuskokwim drainage. The Salmon River (Kuskokwim River tributary) near Nikolai and McGrath also supports a sport fishery on a chinook salmon spawning stock by local residents who use hook and line gear (Stokes 1985). An undocumented amount of angling for chinook salmon takes place on both the Andreafsky and Anvik rivers. Few chinook salmon are harvested in the AYK and Tanana Areas compared to other management areas in Alaska (Mills 1990). Since 1980 the AYK Area chinook salmon sport harvest has ranged from about 1,000 to 2,600 fish, with the majority taken from streams in the lower Yukon-Kuskokwim sub-area (Mills 1990)[3]. The SWHS indicates only a slight increase in harvest since 1980, from levels of about 1,000 in 1980 to harvest estimates of about 1,400 chinook salmon in 1989 (Table 5). An estimated total of 1,391 large sea-run chinook salmon were harvested in 1989 in the AYK Area. In addition, an estimated 1,059 small sea-run chinook salmon (less than 71 cm in length) were harvested in the AYK Area (Tables 6 - 10). When totalled, the estimated 1989 harvest of both small and large chinook salmon in the AYK Area is 2,450 fish.

Coho Salmon:

Coho salmon are distributed widely south of the Brooks Range in the AYK Area, however, they are more abundant in the Kuskokwim River drainage and in drainages to the south than in drainages north of the Kuskokwim River. Returns of coho salmon to the Kuskokwim River may be the largest to a single river in Alaska. Approximately 660,000 coho salmon were harvested in the 1986

[3] Reported harvest figures include fish taken from lower Kuskokwim River and Kuskokwim Bay streams.

Table 6. Lower Yukon-Kuskokwim Rivers sub-area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	KI[d]	KS	SS	LL	RS	PS	CS	LT	DV AC	RT	GR	WF	SF	NP	BB	SM	HA	OTHER
SALTWATER:																					
Boat	114	114	155	0	67	358	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0
Shoreline	76	95	258	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	189	0	0
SALTWATER TOTAL	170[e]	209	413	0	67	358	0	0	0	11	0	0	0	0	0	0	0	0	189	0	0
FRESHWATER:																					
Kanektok River	908	1,494	4,382	280	604	1,096	0	101	45	537	959	1,073	126	58	0	0	23	0	0	0	0
Aniak River	964	1,551	4,035	391	347	939	0	22	34	1,140	63	808	101	909	10	0	70	0	0	0	0
Goodnews River	303	435	1,315	34	34	224	0	146	0	0	38	530	316	198	0	0	0	0	0	0	0
Other Streams	3,161	5,826	8,312	257	223	1,810	0	22	112	883	13	1,223	214	1,749	761	722	3,208	47	1,135	0	0
Lakes	171	209	450	0	0	0	0	0	0	0	13	50	0	0	0	0	175	0	0	0	0
FRESHWATER TOTAL	4,255[e]	9,515	18,494	962	1,208	4,069	0	291	191	2,560	1,086	3,684	757	2,914	771	722	3,476	47	1,135	0	0
GRAND TOTAL	4,293[e]	9,724	18,907	962	1,275	4,427	0	291	191	2,571	1,086	3,684	757	2,914	771	722	3,476	47	1,324	0	0

[a] Lower Yukon-Kuskokwim Rivers Drainage (Area V): All southern drainages of the Yukon River from its confluence with the Tanana River to Kaltag; all drainages of the Yukon River south of Kaltag, including the Kuskokwim River and all waters flowing into Kuskokwim Bay; does not include the Tanana River and the Koyukuk River drainages.

[b] KS: chinook salmon; SS: coho salmon; LL: landlocked coho or chinook salmon; RS: sockeye salmon; PS: pink salmon; CS: chum salmon; LT: lake trout; DV/AC: Dolly Varden or Arctic char; RT: rainbow trout; GR: Arctic grayling; WF:various whitefish; SF: sheefish; NP: northern pike; BB: burbot; SM: smelt;

[c] From Mills (1990).

[d] Chinook salmon less than 711 mm (28 in)

[e] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Table 7. Seward Peninsula-Norton Sound sub-area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	KI[d]	KS	SS	RS	PS	CS	DV AC	RT	GR	WF	SF	NP	BB	SM	OTHER
SALTWATER:																		
Boat	230	328	481	0	0	10	0	39	117	0	0	0	0	0	0	0	0	33
Shoreline	377	607	1,768	19	19	301	68	379	87	55	0	0	0	0	0	0	0	0
SALTWATER TOTAL	558[e]	935	2,249	19	19	311	68	418	204	55	0	0	0	0	0	0	0	33
FRESHWATER:																		
Nome River	1,231	6,219	6,569	19	0	1,233	0	1,573	495	3,551	0	2,032	131	0	0	0	0	0
Pilgrim River	1,017	1,526	1,645	49	19	204	78	301	272	603	0	516	131	0	415	10	410	0
Unalakleet River	394	1,017	1,701	0	49	1,185	0	49	68	570	0	142	17	0	0	0	0	0
Fish-Niukluk River System	509	1,116	1,992	0	0	728	0	233	107	734	0	748	70	0	0	0	0	0
Other Streams	1,265	2,444	3,487	10	19	497	19	990	351	1,545	0	767	104	0	233	0	0	0
Lakes	49	32	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRESHWATER TOTAL	2,560[e]	12,354	15,443	78	87	3,847	97	3,146	1,293	7,003	0	4,205	453	0	648	10	410	0
GRAND TOTAL	3,052[e]	13,289	17,692	97	106	4,158	165	3,564	1,497	7,058	0	4,205	453	0	648	10	410	33

[a] Seward Peninsula-Norton Sound (Area W): All drainage area north of the Yukon River drainage, including all saltwater north and west of Pastol Bay in Norton Sound; and, south of the Selawik River drainage. Does not include the Selawik River.

[b] KS: chinook salmon; SS: coho salmon; RS: sockeye salmon; PS: pink salmon; CS: chum salmon; DV/AC: Dolly Varden or Arctic char; GR: Arctic grayling; WF: various whitefish; NP: northern pike; SM: smelt;

[c] From Mills 1990

[d] Chinook salmon less than 711 mm (28 in)

[e] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Table 8. Northwest Alaska sub-area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	KI[d]	KS	SS	RS	PS	CS	LT	DV AC	RT	GR	WF	SF	NP	BB	SM	OTHER
SALTWATER:																			
Boat	52	70	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shoreline	122	418	420	0	0	0	0	10	0	0	0	0	0	277	498	0	0	261	174
SALTWATER TOTAL	122[e]	488	479	0	0	0	0	10	0	0	0	0	0	277	498	0	0	261	174
FRESHWATER:																			
Kobuk River	278	540	1,465	0	0	0	0	0	10	0	23	0	268	277	131	0	0	0	0
Noatak River	487	627	2,469	0	0	0	0	0	31	46	651	0	912	65	0	64	0	0	0
Other Streams	173	208	219	0	0	0	0	0	0	0	302	0	150	0	0	0	0	0	0
Lakes	209	261	300	0	0	0	0	0	0	69	23	0	85	0	0	0	0	0	0
FRESHWATER TOTAL	1,028[e]	1,636	4,453	0	0	0	0	0	41	115	999	0	1,415	342	131	64	0	0	0
GRAND TOTAL	1,063[e]	2,124	4,932	0	0	0	0	10	41	115	999	0	1,415	619	629	64	0	261	174

[a] Northwest Alaska (Area X): Kotzebue area including drainages of Selawik, Kobuk, Noatak, Wulik, and Kivalina Rivers. All saltwater in the northern half of Kotzebue Sound to and including Point Hope.

[b] KS: Chinook salmon; CS: chum salmon; LT: lake trout; DV/AC: Dolly Varden or Arctic char; GR: Arctic grayling; WF: various whitefish; SF: sheefish; NP: northern pike; SM smelt.

[c] From Mills 1990

[d] Chinook salmon less than 711 mm (28 in)

[e] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Table 9. South Slope Brooks Range sub-area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	KI[d]	KS	SS	CS	LT	DV AC	RT	GR	WF	SF	NP	BB	OTHER
Haul Road Streams	1,522	1,555	2,383	0	0	0	0	0	23	0	1,895	18	0	114	10	0
Koyukuk River	355	338	576	0	0	0	0	0	191	0	552	0	0	52	0	0
Other Streams	1,611	2,536	3,817	0	10	70	639	0	192	0	3,590	27	242	1,145	322	0
Haul Road Lakes	220	135	230	0	0	0	0	0	0	0	198	0	0	187	0	0
Other Lakes	542	712	719	0	0	0	0	272	181	0	333	0	0	167	0	34
TOTAL	3,279[e]	5,276	7,725	0	10	70	639	272	587	0	6,568	45	242	1,665	332	34

[a] South Slope Brooks Range (Area Y): All drainages south of the Brooks Range and north of the Yukon River; including all northern drainages of the Yukon River from Kaltag to the Canadian Border, and, all drainages of the Koyukuk River and Alatna Rivers.

[b] KS: Chinook salmon; CS: chum salmon; LT: lake trout; DV/AC: Dolly Varden or Arctic char; GR: Arctic grayling; WF: various whitefish; SF: sheefish; NP: northern pike; BB: burbot.

[c] From Mills 1990

[d] Chinook salmon less than 711 mm (28 in)

[e] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Table 10. North Slope Brooks Range sub-area[a] sport fish harvest and effort by fisheries and species[b], 1989[c].

	Anglers	Trips	Days Fished	PS	CS	LT	DV AC	RT	GR	WF	SF	NP	BB	SM	OTHER
SALTWATER:															
Boat	68	34	82	0	0	0	0	0	95	27	12	0	0	86	0
Shoreline	223	273	308	0	0	0	34	0	21	73	58	0	0	343	0
SALTWATER TOTAL	257[c]	307	390	0	0	0	34	0	116	100	70	0	0	429	0
FRESHWATER:															
Haul Road Streams	515	1,012	982	0	0	0	149	0	645	0	0	0	0	0	0
Other Streams	480	1,097	1,720	0	0	0	287	0	804	9	0	0	0	0	0
Haul Road Lakes	257	394	390	0	0	149	0	0	306	0	0	0	148	0	0
Other Lakes	324	342	636	0	0	333	561	0	242	0	0	0	0	0	0
FRESHWATER TOTAL	1,183[c]	2,845	3,728	0	0	482	997	0	1,997	9	0	0	148	0	0
GRAND TOTAL	1,423[c]	3,152	4,118	0	0	482	1,031	0	2,113	109	70	0	148	429	0

[a] North Slope Brooks Range (Area Z): All Alaskan waters, including drainages, north of the Brooks Range and flowing into the Beaufort and Chukchi Seas to the north and east of Point Hope. Does not include Point Hope.

[b] PS: pink salmon; LT: lake trout; DV/AC: Dolly Varden or Arctic char; GR: Arctic grayling; WF: various whitefish.

[c] From Mills 1990.

[d] Angler totals may not equal sum of sites due to some anglers fishing at more than one site.

Kuskokwim River commercial fishery, historically the largest commercial harvest for this system (Francisco et al. 1987). Western Alaska coho salmon are thought to spawn primarily in spring-fed portions of streams. The upper Kuskokwim River and its tributaries that drain the northern slopes of the Alaska Range are extensively underlain with alluvial gravels as a result of outwash from the Alaska Range. The resulting gravel aquifers provide high quality spring water for spawning and rearing of coho salmon in the Kuskokwim drainage, and fall chum salmon in the Yukon and Tanana River drainages. SWHS results in 1989 indicate that the majority of the coho salmon recreational harvest in the AYK Area was from streams in the Seward Peninsula-Norton Sound sub-area and from the lower Yukon-Kuskokwim sub-area (Mills 1990). The sport harvest estimate of coho salmon from the lower Yukon-Kuskokwim sub-area in 1989 was 4,427 fish, of which 1,096 were taken from the Kanektok River (Table 6).

Coho salmon are locally abundant north of the Yukon River in Norton Sound, where coastal and stream fisheries occur at least as far north as Teller. Several streams of eastern Norton Sound (Figures 11 and 12) including the Unalakleet, Shaktoolik, Fish, and Niukluk rivers support spawning stocks of coho salmon, as do many of the streams in the Nome area, Port Clarence, and Safety Sound. Active sport fisheries occur in these areas for coho salmon. The 1989 SWHS estimate for coho salmon in the Norton Sound-Seward Peninsula sub-area was 4,158 fish (Table 7). The Nome and Unalakleet rivers accounted for the majority of the harvest. Coho salmon occur north of Port Clarence, but as with other freshwater rearing salmon species, their abundance decreases markedly at higher latitudes.

Pink Salmon:

This species rarely undertakes extensive freshwater migrations (more than 160 km) and as a consequence, it is not abundant upstream of the lower main stems of the major river systems of the AYK Area. For example, pink salmon seldom ascend the Yukon River beyond the Anvik River (513 km), or the Kuskokwim River beyond the Holitna River (540 km). Estimated 1989 harvest of AYK Area pink salmon was 3,765 fish, of which all but 10 were taken in the Norton Sound-Seward Peninsula sub-area (Table 5).

Pink salmon are a target species in Norton Sound sport fisheries where harvest estimates have ranged from 1,100 (1985) to more than 13,000 (1982). The recent (1980-1989) ten year average sport harvest is 4,957 fish. Even-year harvests for the five years of this period averaged 7,176 fish, while harvests during odd years averaged 2,738 fish. Pink salmon utilize numerous streams in Norton Sound for spawning, and in some years large returns are documented. Extremely large returns have been recorded for the Unalakleet River, the Kwiniuk River and Tubutulik River (Lean et al. 1986). For example more than 6 million pink salmon are estimated to have spawned in the Unalakleet River in 1984 (Lean 1985). Returns of this species are extremely variable even in more southerly latitudes. The common two-year cycle of pink salmon return abundance is not as pronounced in Norton Sound and in more northerly areas, although the magnitude of return variation is large because of climatic variation at higher latitudes. Snow cover, depth, and mean monthly temperatures during the winter months all affect ice thickness and the amount

of frozen versus unfrozen groundwater in local streams of the area. Salmon egg and fry survival rates are directly affected by the amount of freezing in the stream gravels where incubation takes place.

Non-rearing species such as pink and chum salmon may have an advantage in northern streams where freshwater productivity is much lower than in lower latitudes. Sport and subsistence fisheries in the Nome area for pink salmon in local streams such as the Nome, Snake and Sinuk rivers are active in late July and early August.

Arctic Grayling:

Arctic grayling inhabit waters throughout the AYK Area where they are probably the most popular sport fish species present. Most of the freshwater drainages that have been surveyed along the Arctic coast contain Arctic grayling (USFWS 1982). It is the principal species inhabiting foothill lakes and streams on the Seward Peninsula and they occur in lakes and streams emptying into the Chukchi Sea between Kotzebue and Barrow (ADFG 1978, 1986). Arctic grayling also migrate through, or inhabit during parts of the year, main stems and tributaries of the largest rivers such as the Yukon, Kuskokwim, Porcupine, Koyukuk, Kuskokwim, Noatak, Kobuk and Colville rivers.

Arctic grayling typically spawn in smaller, clear headwaters with gravel bottoms and low stream gradients, usually during May and early June. After spawning, the adults disperse throughout the streams for summer feeding. Juveniles and sub-adults are frequently found rearing during summer months in far upstream reaches that become dewatered in winter. Fish overwinter in lower stretches of tributaries where water and oxygen concentrations are adequate, as well as in lakes and spring fed portions of streams. Summary descriptions of distribution, life history and abundance of Arctic grayling in the AYK Region are provided in Alaska Habitat Management Guides for the Interior, Western and Arctic Regions (ADFG 1986).

SWHS results indicate that since 1977, the Arctic grayling harvest in the AYK Area has ranged from about 10,000 fish in 1977 to more than 30,000 in 1983. Since 1983, estimated harvests have declined, and have ranged from 15,500 in 1984 to 19,700 in 1986, with 17,215 being taken in 1989 (Table 5). The Arctic grayling harvest is usually taken fairly evenly from the five sub-areas, with from about 1,000 to 9,000 Arctic grayling taken in each sub-area (Tables 6 - 10). The largest harvest estimate in 1989 (6,568 fish) was for the South Slope Brooks Range sub-area (Table 9).

Northern Pike:

Sloughs, interconnected lakes, and the lower sections of large rivers throughout most of the AYK Area are inhabited by northern pike. Lowland areas of the Yukon and Kuskokwim rivers are particularly noted for large northern pike. Northern pike are abundant in all parts of the AYK Area containing appropriate habitat except on the north slope of the Brooks Range, where their distribution is limited. Bendock and Burr (1985) reported the presence of northern pike on the Arctic coastal plain west of the Colville River, in

rivers and lakes draining into Admiralty and Smith Bays (Figure 21) and in middle reaches of the Killik River, tributary to the Colville River.

During summer, northern pike are generally distributed near shore in shallow water that contains aquatic vegetation and a mud bottom. Northern pike have some tolerance for salinity and they are taken frequently in brackish waters of the Yukon-Kuskokwim Delta. They are not known to feed or travel extensively in marine or coastal waters outside the major rivers. During winter, northern pike congregate in deep, well-oxygenated waters found in the lower reaches of tributaries or other areas of sufficient water flow (Hallberg 1984).

Most of the recreational harvest of northern pike is taken with hook and line. Spearing, bow and arrow, and hand jigging techniques are also legal means and account for a small proportion of the total harvest. Northern pike sport fishing occurs in the Kuskokwim River drainage from McGrath to downstream of Bethel, including the Takotna, Nixon Fork, Holitna, and Johnson rivers. Most recreational fishing for northern pike along the Yukon River takes place upstream from Galena. Popular areas include the Yukon Flats near Fort Yukon, Koyukuk River, Beaver Creek, Birch Creek, Dall River, Hess Creek, Tozitna River, Melozitna River, and Nowitna River. The Pilgrim, Kuzitrin, and Fish rivers in the Nome area are popular as well.

Major use of northern pike in the AYK Area is probably for subsistence. Although harvest levels are largely undocumented, they are thought to exceed recreational harvests. Much of the recreational and some of the subsistence harvest is taken during winter months through the ice with hook and line gear. Sport fishing for northern pike has gained in popularity since the early 1960's. Northern pike are eagerly sought by fishermen in areas that have good boat access. They are often fished in the fall in combination with hunting activities.

The estimated sport harvest of northern pike in the AYK Area has ranged from about 2,000 fish in 1977 to more than 8,600 fish in 1983 (Mills 1979-1990). The estimated harvest in 1989 was 5,853 fish (Table 5). Generally, the largest harvests have been taken in the lower Yukon-Kuskokwim sub-area. Estimated 1989 harvest from this sub-area was 3,476 northern pike, followed by 1,665 from the south slope Brooks Range sub-area. (Tables 6 - 10).

Little is known concerning the status of northern pike stocks in the AYK Area, but because of remoteness and restricted access, fishing effort is light except on those stocks near towns and villages where angling and subsistence gill netting effort may be more intense. Northern pike populations close to the Yukon River Haul Road Bridge have experienced more angling pressure because the recent opening of the road has allowed easy boat access to people living in the Fairbanks area. Northern pike population studies conducted in the Tanana River drainage suggest that abundance and stock composition parameters such as age and size composition respond negatively and rapidly when annual harvest exploitation rates exceed 16%.

Lake Trout:

Historically, approximately 35% of the total AYK Region harvest of lake trout has occurred in the AYK Area. In 1986, the percentage taken outside the Tanana River drainage was much larger (88%) due to declines in catch and perhaps abundance within the Tanana River drainage. Harvest in 1989 for the entire region totalled 3,887 fish[4], of which 1,955 fish (19%) were taken from the AYK Area (Table 5). Harvest values for the AYK Area since 1977 have ranged from about 500 fish in 1977 and 1988 to about 2,500 in 1986 (Table 5).

ADFG studies indicate that lake trout resources have been overharvested in many of the more accessible waters of south-central and interior Alaska. Specific life history features (slow growth, delayed maturity, and non-consecutive spawning) combined with the short growing season at higher latitudes and altitudes increases the vulnerability of the species to overharvest.

Burr (1987) described the distribution of lake trout in Alaska. Lake trout are most frequently associated with deep, oligotrophic lakes in the mountains and are rarely found at lower elevations of the Yukon or Kuskokwim basins (Redick 1967; Morrow 1980). In northwest Alaska, lake trout occur in lakes and streams of the Brooks Range in the Noatak and Kobuk River drainages. Lake trout are found in most drainages that flow into the Yukon River from the Brooks Range. Lake trout distribution is primarily restricted to lakes at higher elevations in these drainages. Lake trout are widely distributed on the north slope of the Brooks Range. They occur most frequently in mountain and foothill lakes, but they also occur in streams of the Colville, Sagavanirktok, and Canning River drainages. Lake trout generally do not occur in the lowland lakes of the Arctic coastal plain, but they occur commonly in central coastal plain lakes between the Ikpikpuk and Colville rivers.

ADFG has conducted little research on this species in areas outside of the Tanana Valley and near Glennallen. Lake trout research is being conducted by federal agencies, such as USFWS, NPS (National Park Service), and BLM (Bureau of Land Management) in National Wildlife Refuges, National Parks, National Preserves and other unclassified lands.

Dolly Varden/Arctic Char:

The majority of the harvest of Arctic char or Dolly Varden (collectively referred to as char in this section) in the region occurs in the AYK Area since only the dwarf stream resident form is found in the upper Yukon and Tanana River systems. Char occur in most of the waters of western and Arctic Alaska, either in the anadromous, river resident, lake resident, or stream dwarf forms. Char are a target species for subsistence and sport fisheries in waters of the Arctic, Kotzebue vicinity, Seward Peninsula, and Norton Sound.

Two species are recognized within the AYK Area based upon meristic characters, (gill raker and pyloric caecae counts), life history features and the occurrence of anadromy (Behnke 1980). Dolly Varden are the dominant species

---

[4] See remarks on harvest estimate accuracy for the Tanana Area, page 22.

from Bristol Bay north to the Arctic plain, and occur in either the anadromous, stream resident or stream dwarf form, while Arctic char occur only as residents in foothill lakes of the North Slope (Chandler Lake Campsite Lakes, etc; Figures 17 and 22), the Kobuk River drainage (Walker and Selby lakes; Figure 15), the Seward Peninsula (lakes of the Kigluaik Mountains; Figure 12), and the Kuskokwim Mountains (Aniak, Kisaralik, Kagati, and Goodnews lakes; Figure 9). The majority of char in the AYK Area are Dolly Varden of either the stream resident or anadromous type. They occur throughout the area but are most abundant in tributaries of the lower Yukon and Kuskokwim rivers, Norton Sound, Northwest Alaska, and along the north slope of the Brooks Range and the Arctic coastal plain. Morrow (1980) distinguishes two distinct forms of Dolly Varden in Alaska based upon gill raker and vertebral counts. The southern form usually occurs only south of the Alaska Range, however examination of specimens collected in the upper reaches of the Copper, Tanana, Nenana, and Susitna Rivers indicates that non-anadromous southern and northern forms occur on both sides of the Alaska Range passes. Morrow (1980) argues that headwater transfer, which may still be occurring, is responsible for the mixing of southern and northern forms in these areas.

Sport harvests of char in the AYK Area between 1977 and 1989 have ranged from approximately 4,000 fish to more than 20,000 fish (Table 5). This represents from less than 5% to about 20% of the statewide total harvest (Mills 1979-1990). The estimated harvest in 1989 was 13,359 fish from the AYK Area, with the majority of the harvest in the Seward Peninsula-Norton Sound sub-area Tables 5 - 10). Typically, the largest percentage of the harvest is taken in the Seward Peninsula-Norton Sound sub-area. High quality sport fishing for char is available in northwest Alaska, particularly in the Wulik, Kivalina, and Noatak rivers north of Kotzebue, when trophy Dolly Varden move into the streams for either overwintering or spawning in the fall. The Noatak River in northwest Alaska supports populations of spawning char in its tributaries. Important spawning tributaries include the Kelly River, Kogururok River, and the Nimiuktuk River (DeCicco 1985). Incidental commercial harvest as well as directed subsistence harvests account for the highest proportion of the annual fishing mortality in northwest Alaska in most years (Bernard and DeCicco 1987).

During the period from 1967 to 1989, 20 trophy char (24% of the Alaska total) were registered from the AYK Area, including the state record char, (7.9 kg; 17 lbs 8 oz) taken from the Wulik River in 1968. All except one of the trophy char taken in the AYK Area came from northwest Alaska.

Burbot:

Burbot are distributed throughout the AYK Area in all major rivers and many of the lakes and minor waterways. It is an important fisheries resource for subsistence economies of rural Alaska and for sport fisheries. Burbot are members of the cod family, *Gadidae*, and spawn in midwinter under the ice of rivers and lakes. Sport fishing interest and intensity has increased for the species in recent years, particularly near settlements where burbot fishing provides an outdoor wintertime activity for many people. Reported annual sport harvests of burbot in the AYK Area since 1978 have ranged from just over

100 fish to approximately 2,000 fish (Table 5). The majority of the harvest and fishing effort occurs in the winter with lines set through the ice, although hand-held lines with rod and reel are also used in summer and winter months. The majority of the burbot sport harvest in the AYK Region takes place in the Tanana River drainage. The estimated 1989 AYK Area harvest of burbot was only 537 fish (Table 5).

Only three of the 166 Alaska trophy burbot registered from 1967 to 1989 were taken in the AYK Area, a fact that is no doubt reflective of lack of sport fishing effort in much of the area.

Whitefish:

Although members of the whitefish family, *Coregonidae*, are seldom considered to have substantial recreational value, as a group they constitute an extremely important fisheries resource in the AYK Area. They are taken year around by subsistence fisheries and are utilized for human consumption as well as for dog food. In addition, various whitefish species provide a forage base for many of the predatory fishes that support important sport fisheries such as northern pike, burbot, and sheefish. The most important whitefish species in northern, western and interior Alaska include the humpback whitefish, broad whitefish, round whitefish, Arctic cisco, least cisco, and Bering cisco.

Recreational fisheries throughout the area account for a very small proportion of the total harvest of all species of whitefish. An estimated harvest of 1,997 whitefish was taken by sport anglers in 1989 in the AYK Area (Table 5). The magnitude of the whitefish subsistence harvest is not well documented except in a few specific instances, but is believed to be orders of magnitude greater than the sport harvest in the AYK Area. Where salmon are not available, and during the winter months, whitefish are the major source of fish for subsistence use. Such a situation prevails over the entire North Slope, and in many of the remote villages of interior Alaska located beyond the upstream limits of the salmon runs. Limited commercial fisheries for whitefish exist in the AYK Area.

Sheefish:

Sheefish are large, predatory whitefish found throughout western, interior, and northwestern Alaska. They do not occur in streams of the North Slope nor in Norton Sound north of the Koyuk River. Alt (1987) identified nine stocks of sheefish, with anadromous-estuarine stocks occurring in the Kuskokwim, lower Yukon, Koyuk, Kobuk-Selawik rivers, and resident non-anadromous stocks in Yukon River tributaries of the Nowitna, Tanana River (Minto Flats), Porcupine, and Salmon Fork of the Black River, as well as the main stem of the upper Yukon River. The distribution of this species in Alaska is limited to the AYK Region.

Sheefish are harvested by subsistence, commercial, and recreational users with subsistence harvests exceeding all others. The major commercial fishery (Kotzebue Sound) is limited by a harvest quota of 11,350 kg or approximately 3,300 fish annually (Lean 1985). Reported sales of sheefish from this commercial fishery have only once (in 1977-78) reached the allowed quota (Lean

et al. 1986). During the period from 1978-1989, estimates of the recreational harvest in the AYK Area ranged from about 1,000 to about 4,700 fish (Table 5). The harvest estimate for the AYK Area in 1989 was 1,997 sheefish. Kobuk and Selawik River sheefish are the most abundant and heavily fished stocks. Harvest occurs on a year-round basis from subsistence, commercial and sport fishermen, from spawning grounds in the upper Kobuk River to the coastal inlets, Hotham Inlet and Selawik Lake near Kotzebue and Selawik villages. The data base for sheefish stocks of the Kobuk and Selawik rivers is not adequate to allow the precise determination of sustainable yields for the stocks. The size of the spawning stocks has been poorly documented as has the harvest and biological composition of the harvest. Because of life history features that favor late maturation, slow growth, nonconsecutive spawning, and the existing harvest pressure on major stocks, there is concern that the Kobuk and Selawik river stocks may be experiencing harvests beyond sustainable levels. The question cannot be addressed until further biological information becomes available.

Sheefish generally overwinter in lower reaches of rivers and estuarine waters, migrate upstream in summer to feeding grounds, and migrate further upstream to spawning grounds in the late summer and fall. Migrations of over 1,650 km have been documented. Sheefish spawn in late September and early October at water temperatures of 0 - 5°C. Aerial survey estimates of the number of spawning sheefish on the Kobuk and Selawik rivers are available for seven years between 1966 and 1979. The highest aerial survey count for the Kobuk River was 8,166 spawning sheefish in 1971 (Alt 1987). A total of 1,243 spawners was observed in the Selawik River in 1968, one of two years when surveys were made on this stream. It is not certain that spawning grounds have been identified for all major sheefish stocks. Availability of spawning habitat with desired current (2 m per sec), water depth (2 m), and bottom substrate of differentially-sized gravels may be the most critical factor limiting sheefish distribution and abundance (Alt 1987).

Rainbow trout:

In only two known instances have rainbow trout been introduced into waters of the AYK Area. Approximately 3,000 fingerling were released into a man-made, landlocked reservoir known as Webster Reservoir in Prudhoe Bay in 1977. Fate of the transplanted fish was not assessed in subsequent years. Since the reservoir is used as an industrial water source in the winter, water levels are often drawn down severely, increasing the likelihood of winter kill from hypoxia or freeze-out.

In a second instance, rainbow trout were released into Roy's Pond near Central in 1987. The pond is a 15.38 ha (38 ac) waterbody with an outlet stream that does not flow except at extreme high water, into Crooked Creek, tributary to Birch Creek in the Yukon River drainage. The 1987 release consisted of 10,000 fingerling rainbow trout. The success of the stocking in producing catchable rainbow trout in the pond in subsequent years has not been assessed.

STAFF ORGANIZATION

Regional Staff Responsibilities

Organization of the region staff is outlined in Figure 24. All activities were directed by the Regional Supervisor (J. Clark) who delegated appropriate tasks to the Administrative Assistant (E. Nielsen), the Research Supervisor (R. Holmes) and the following Fishery Biologist III's: W. Arvey, J. Hallberg, and M. Kramer. Lake stocking activities were the responsibility of M. Doxey. Area management responsibility and emergency order authority was vested with two positions, W. Arvey (AYK Area), and J. Hallberg (Tanana Area). Each area manager conducted fisheries research projects in the respective areas. The AYK Area biologist was responsible for a northern pike study near the North Slope Haul Road Yukon River crossing, and the Tanana River Area biologist for a whitefish project on the Chatanika River. Special research was conducted by W. Ridder on stock assessment of Arctic grayling in the Salcha, Chatanika and Goodpaster rivers, and in the Tangle lakes, all in the upper Tanana Valley. Arctic grayling research in the Salcha, Chena, and Chatanika rivers near Fairbanks, and in Fielding Lake near Delta was conducted by R. Clark. T. Baker conducted Arctic grayling research in the Tangle lakes. M. Merritt was responsible for the interior Alaska creel census project. Char research was conducted in northwest Alaska by A. DeCicco, who also directed Arctic grayling studies on the Seward Peninsula. Lake trout research in the Tanana River drainage and Copper River was conducted by J. Burr. Burbot research in rivers of the upper Tanana Valley was conducted by M. Evenson. F. Parker conducted a study of burbot in lakes of interior Alaska. Northern pike studies were conducted by G. Pearse and A. Burkholder in the Tanana River drainage, and by W. Arvey in the Dall River. Evaluation of the fish stocking program was conducted by C. Skaugstad, M. Doxey, and J. Clark. Adult chinook salmon abundance in the Salcha and Chena rivers was estimated by C. Skaugstad. Fisheries information and education as well as the fisheries access program were the duties of M. Kramer.

Synopses of Published Reports

The intent of the following section is to provide a brief overview of AYK Region fisheries studies completed during the reporting year. Since AYK Region activities are documented by technical reports following each field season, the report itself is cited, followed by a brief synopsis.

Arvey, W. D. and A. Burkholder. 1990. Stock assessment of northern pike in the vicinity of the Yukon River Haul Road crossing, 1988 and 1989. Alaska Department of Fish and Game. Fishery Manuscript No. 90-1. 38 pp.

Northern pike were tagged and sampled from six streams located in the vicinity of the Yukon Haul Road Bridge to estimate abundance of the population of Dall River northern pike and to determine whether the population is closed or open to immigration. Recaptures in 1988 and in 1989 showed that immigration to, and emigration from, the Dall River occurs. Thus, the population must be considered geographically open. The population estimate of northern pike in the lower 18 km was 4,385 fish (SE = 313), however because of known

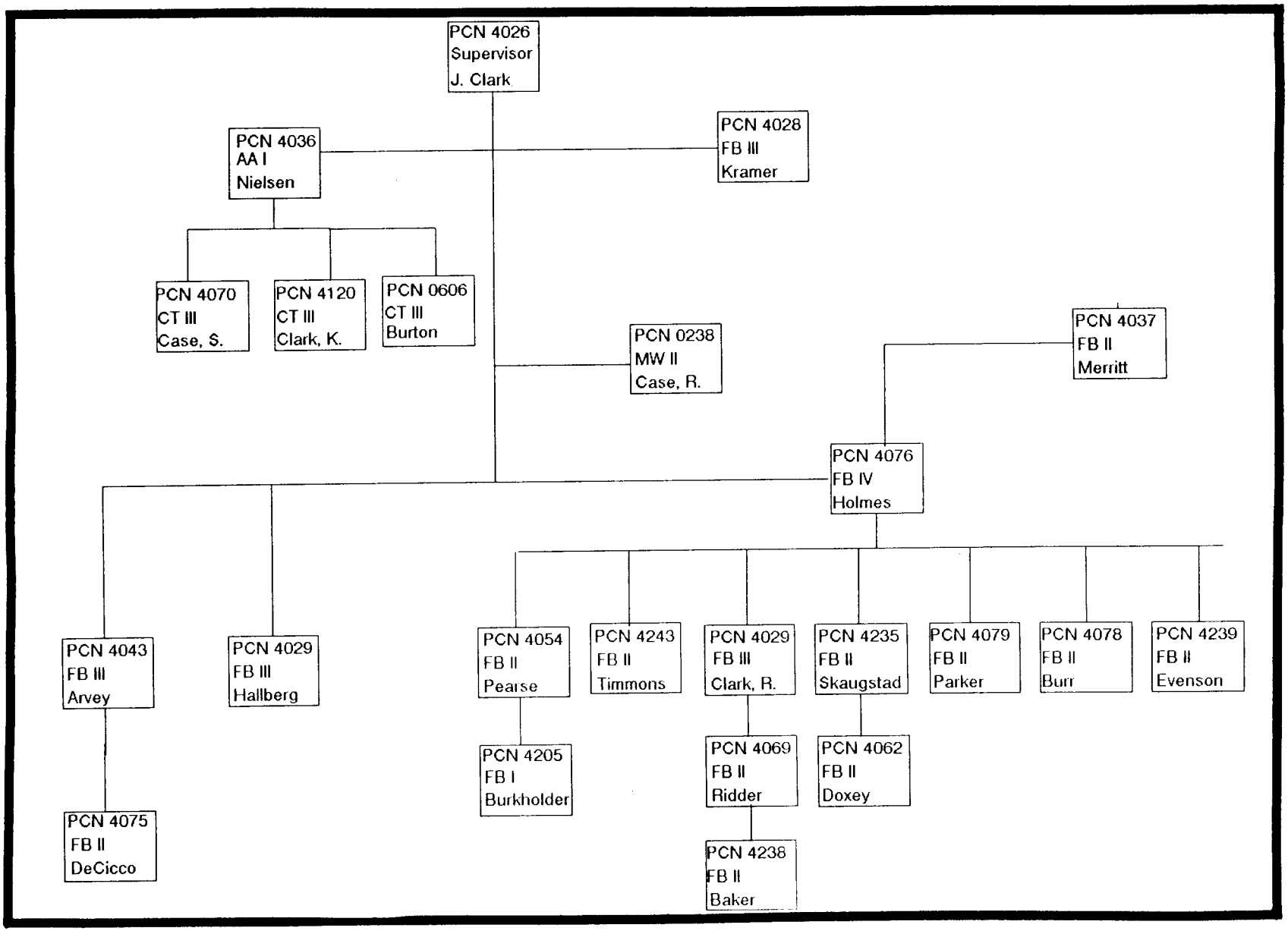


Figure 24. Organizational chart for A-Y-K Sport Fish staff, January, 1989.

recruitment from both movement and growth of individuals, the estimate is considered to be biased high.

Arvey, W. D. 1990. Opinions and regulatory preferences of northwest Alaska anglers. Flaska Department of Fish and Game. Fishery Data Series No. 90-18. 52 pp.

Angler preferences for types of fishing experience as well as for regulatory and management options for the Dolly Varden and sheefish sport fisheries in Northwest Alaska were solicited in 1989 with mailed questionnaires. Results indicated that only local residents participated significantly in other Northwest Alaska fishery categories (personal use, commercial, or subsistence). Local residents were more motivated by food as a reason for sport fishing than were nonlocals and nonresidents. Nonresidents were motivated by noncatch reasons more than were other residence groups. Food-motivated anglers rated overall fishing enjoyment lower than did those motivated by sport or non-catch reasons.

Burkholder, A. 1990. Stock composition of northern pike in Minto Flats during 1989. Alaska Department of Fish and Game. Fisheries Data Series No. 90-25. 25 pp.

Abundance estimates of northern pike were not acheived due to insufficient numbers of fish captured, possibly because of extensive spring flooding. Sex, age, and size composition of northern pike was measured.

Clark, R. A. 1990a. Stock assessment of Arctic grayling in Fielding Lake. Alaska Department of Fish and Game. Fishery Data Series No. 90-1. 29 pp.

Mark-recapture estimates of abundance of Arctic grayling greater than 199 mm in fork length were 4,184 fish in June, 1987, and 8,525 fish in June, 1988. Recruitment between 1988 and 1989 was estimated at 5,019 fish. Onset of sexual maturity of Fielding Lake Arctic grayling was at four years, (fifth summer) and 260 mm fork length. Fifty percent were sexually mature at five years and 313 mm fork length.

Clark, R. A. 1990b. Stock status of Chena River Arctic grayling. Alaska Department of Fish and Game. Fishery Data Series No. 90-4. 52 pp.

Stock status of Arctic grayling was described in the lower 152 km of the Chena River by population abundance, age composition, size composition, recruitment, and survival estimates. Estimated population abundance in 1989 was 19,028 Arctic grayling greater than 149 mm in fork length. Annual recruitment between 1988 and 1989 was 4,332 Arctic grayling and annual survival was 58.7% during this period. It was concluded that if annual recruitment remained low, additional regulatory measures would be needed to prevent short term depletion of the Chena River stock.

Clark, R. A. and W. P. Ridder. 1990. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers. Alaska Department of Fish and Game. Fishery Data Series No. 90-7. 84 pp.

Arctic grayling stock assessment was carried out by means of esimation of population abundance, age composition, and size composition. Population abundance in a 36.8 km section of the Salcha River was 6,935 Arctic grayling greater than 149 mm in fork length. Population abundance in the lower 50 km section of the Goodpaster River was 8,033 Arctic grayling greater than 149 mm in fork length. Poor recruitment of 1984 and 1985 cohorts to the Goodpaster and Chatanika rivers was reflected in the paucity of age 4 and 5 fish in 1989. All historical data on age, size, and sex compositions, harvest and effort, and population abundance from 1952 to 1989 are presented.

Burr, J. M. 1990. Stock assessment and biological characteristics of lake trout populations in interior Alaska, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-33. 50 pp.

Lake trout were sampled from Paxson Lake (Copper River drainage), Butte Lake (Susitna River drainage), Fielding, Glacier, and Sevenmile lakes (Tanana River drainage), and Island Lake (North Slope). Most large trout (> 715 mm fork length) were found in Paxson Lake. A few fish in this size category were found in Fielding Lake, and smaller fish (< 500 mm fork length) were captured in all the other lakes. Ages of lake trout determined with otoliths ranged from 0 to 33 years, with most between 4 and 20 years. The abundance estimate of lake trout greater than 345 mm was 942 (29 fish per ha) in Sevenmile Lake and 4,440 (14 fish per ha) for lake trout 250 mm and larger in Butte Lake. The estimated abundance of spawning lake trout in Paxson Lake was 4,895 (three fish per ha). The estimated density of lake trout of mature size was 24 fish per ha in Sevenmile Lake, and seven fish per ha in Butte Lake.

DeCicco A. L. 1990. Seward Peninsula Arctic grayling study 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-11. 30 pp.

Population abundance, age composition, length composition, growth, and Relative Stock Density were estimated for Arctic grayling in the Niukluk River and Sinuk River. The estimated abundance in a 22 km section of the Niukluk River was 3,032 Arctic grayling over 200 mm in fork length (SE = 816) or 138 fish per km. Arctic grayling from the Niukluk River ranged from 147 mm to 477 mm in fork length with a mean fork length of 352 mm. Sinuk River Arctic grayling ranged from 308 to 528 mm in fork length with a mean of 449 mm. Sinuk River Arctic grayling grew faster and reached a larger size at age than did fish from the Niukluk River.

Decicco A. L. 1990. Northwest Alaska Dolly Varden study 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-8. 42 pp.

The spring 1989 subsistence fishery for Dolly Varden harvested 1,889 fish. A mark-recapture experiment estimated the population size in the Wulik River to be 76,892 fish (SE = 16,811) over 400 mm in fork length in the winter of 1988/1989. During an aerial survey on 13 September 1988, 80,144 Dolly Varden were counted. The mean length of Dolly Varden in the overwintering population was 425 mm and the sex ratio was one male to 1.7 females. Recaptured Dolly Varden grew an average of 25 mm in fork length over the winter and movements as far as 1,540 km were documented from tag recoveries. An estimated 4,874

Dolly Varden were harvested incidentally in the 1989 Kotzebue Sound commercial salmon fishery. The 1989 fall subsistence Dolly Varden harvest at Kivalina was 4,820, and 4,500 at Noatak. During 1989 aerial census of overwintering populations, 56,384 and 5,090 Dolly Varden were counted in the Wulik and Kivalina rivers, respectively.

Evenson, M. J. 1990. Movement, abundance, and length composition of burbot in rivers of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-3. 26 pp.

Mean total lengths of Tanana River burbot ranged from 412 to 533 mm in all sampling locations. Burbot in the Yukon, Tolovana, Chena, and Chisana rivers were generally larger than those sampled from the Tanana River, but those sampled in the Kantishna and Goodpaster rivers were smaller than Tanana River fish. Relative mixing rates of burbot throughout the Tanana River drainage show movement of burbot occurs throughout the length of the mainstem Tanana River and between tributaries and the mainstem Tanana River, indicating that burbot in the drainage are of a single stock. Proportions of movement during the period from river freeze-up to time of spawning were higher than during other times of the year, indicating there are seasonal migrations to spawning areas and a return migration to oversummer areas.

Guinn, D. A. and J. E. Hallberg. 1990. Precision of estimated ages of burbot using vertebrae and otoliths. Alaska Department of Fish and Game. Fishery Data Series No. 90-17. 17 pp.

The precision of repeated age estimnates made by four readers using vertebrae and otoliths collected from 156 burbot was examined using analysis of variance and the indices of standard deviation, average percent error, and coefficient of varation. Age estimates were concluded to be relatively precise within and among structures. Both vertebrae and otoliths were determined to be suitable candidates for age validation studies.

Hemming, C. R. 1990. Fisheries investigations of flooded North Slope gravel mine sites, 1989. Alaska Department of Fish and Game, Division of Habitat. Technical Report No. 90-2. 38 pp.

Information is presented on the species composition and length-frequency distribution of fish captured at six flooded gravel mine sites in the Prudhoe Bay and Kuparuk oilfield development areas. The objective of the fish sampling program is to provide information on the seasonal use of several different habitat types resulting from North Slope gravel extraction activities. This information will guide habitat enhancement of gravel mine sites with the goal of increasing biological productivity and use by fish and wildlife.

Holmes, R., D. N. McBride, T. Viavant, and J. B. Reynolds. 1990. electrofishing induced mortality and injury to rainbow trout, Arctic grayling, humpback whitefish, least cisco, and northern pike. Alaska Department of Fish and Game. Fishery Manuscript No. 90-3. 95 pp.

Species studied were rainbow trout, Arctic grayling, northern pike, humpback whitefish, and least cisco. Rainbow trout sustained high rates of mortality (13.9%) and injury (40.9%) and electrofishing has been discontinued as a method of sampling for this species. Northern pike sustained a moderate rate of injury (12.5%), significantly higher than the control sample. It was recommended that electrofishing only be used as a capture method for northern pike when it is not possible to use other gear types. Injury rates for Arctic grayling ranged from 0% to 18.3%. It was concluded that electrofishing does not have substantial detrimental effects on Arctic grayling. Neither species of whitefish sustained injury due to electrofishing. It was recommended that the most useful method of assessing the effects of electrofishing is at the population level, by testing for differential survival and growth over time between test and control groups of fish.

Lafferty, R., J. F. Parker, and D. R. Bernard. 1990. Stock assessment and biological characteristics of burbot in lakes of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-48.

Abundance or indices of abundance were estimated in 18 interior Alaska lakes of the Susitna River, Tanana River, and Copper River drainages. The abundance of fully recruited burbot was estimated using mark-recapture experiments in 10 lakes and ranged from 97 burbot in T Lake to 3,458 burbot in Lake Louise (in 1988). Annual rates of survival ranged from 35% in Lake Louise and Round Tangle Lake to 89% in Fielding Lake. Size and age compositions of burbot varied widely among lakes.

Merritt, M. F., A. E. Bingham, and N. Morton. 1990. Creel surveys conducted in interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-54. 125 pp.

Creel surveys were conducted on seven Tanana River drainage fisheries. They included the Chatanika River whitefish spear fishery, upper Chena River Arctic grayling fishery, lower Chena River chinook salmon fishery, Delta Clearwater River Arctic grayling fishery, Piledriver Slough rainbow trout and Arctic grayling fisheries, Salcha River chinook salmon fishery, and Harding Lake Arctic char and northern pike fisheries. Estimated harvest of whitefish in the Chatanika River was 16,068 (SE = 1,611). Estimated harvest in the upper Chena River was 3,325 (SE = 1,455) Arctic grayling. Chinook salmon harvests in the lower Chena River and Salcha River were 685 (SE = 224) and 123 (SE = 43) repectively. The estimated harvest of northern pike in Harding Lake was 1,237 (SE = 453). The estimated harvest of Arctic char in the winter in Harding Lake was at least 200 fish. Surveys of other fisheries documented harvest-per-unit-effort.

Pearse, G. A. 1990. Abundance and age, sex, and length composition of the northern pike populations of George, Volkmar, and T Lakes, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-42. 36 pp.

Abundance of northern pike greater than 299 mm in fork length in George Lake was estimated at 25,466 (14/ha). The two-season estimate of 1988 northern pike abundance in Volkmar Lake was 2,766 (10/ha), the lowest number estimated

since 1986. Abundance and population composition of T Lake northern pike was not estimated in 1989. Length composition of northern pike in Volkmar Lake reflected poor recuitment and fewer large fish than in previous years. Length composition of northern pike in George Lake reflected increased recruitment and cohort strength between years. Recruitment of age 5 northern pike increased in George Lake and decreased in Volkmar Lake.

Ridder, W. P. 1990. Stock assessment of Arctic grayling in the Tangle Lakes and River system 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-15. 55 pp.

Estimates of age and size composition and Relative Stock Density are presented from samples from 14 locations. Three spawning area were found. Adult males were larger and older than adult female Arctic grayling.

Skaugstad, C. 1990a Effects of fin removal on survival and growth of Arctic char in a hatchery environment. Alaska Department of Fish and Game. Fishery Data Series No. 90-28. 11 pp.

Short-term survival and growth of Arctic char marked with various finclips and Floy anchor tags was studied at Clear Hatchery. Mean length of the Arctic char used in the study was about 300 mm. There was no difference between the rates of survival for each finclip treatment group. There was, however, a significant difference between rates of growth of fish marked with the various finclips. There was a small but significant difference between the rates of survival for Arctic char marked with Floy anchor tags (0.98) and unmarked Arctic char (0.99). The rate of tag loss was estimated to be about 0.05.

Skaugstad, C. 1990b. Abundance, egg production, and age-sex-size composition of the chinook salmon escapement in the Chena River, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-13. 32 pp.

The estimated abundance of chinook salmon in the Chena River in 1989 was 2,666 (SE = 249) adult spawning fish. During aerial surveys, the highest count of live and dead chinook salmon was 1,180, about 44% of the mark-recapture point estimate. The estimate of egg production for the 1989 escapement was 9.81 million eggs (SE = 0.80).

Skaugstad, C. 1990c. Abundance, egg production, and age-sex-size composition of the chinook salmon escapement in the Salcha River, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-23. 32 pp.

The estimated abundance of adult spawning chinook salmon in 1989 was 3,294 fish. During aerial surveys, the highest count of chinook salmon was 2,333; about 71% of the mark-recapture point estimate. Estimated egg production of the escapement was 16.63 million eggs (SE = 1.85 million).

Timmons, L. S. 1990. Abundance and length, age, and sex composition of Chatanika River humpback whitefish and least cisco. Alaska Department of Fish and Game. Fishery Data Series No. 90-2. 40 pp.

Abundance of humpback whitefish and least cisco was estimated in a section the Chatanika River between the Elliott Highway Bridge and the Olnes Pond Campground with a Petersen mark-recapture experiment. Totals of 17,322 (SE = 1,655) humpback whitefish and 53,409 (SE = 5,110) least cisco were estimated in the section. Shifts in age and length compositons were apparent from 1986 through 1989.

Viavant, T. R. and J. H. Clark. 1990. Opinions and regulatory preferences of anglers resident in urban and rural portions of the Tanana drainage in 1988. Alaska Department of Fish and Game. Fishery Data Series No. 90-19. 128 pp.

Survey results suggested that Tanana drainage anglers can be generally grouped into rural anglers who are more likely to be food motivated, are less receptive to restrictive regulations, rate fishing quality higher, and are more likely to target Arctic grayling, and, urban anglers who are more likely to be sport motivated, are more receptive to restrictive regulations, rate fishing quality lower, and are more likely to target rainbow trout. Arctic grayling and rainbow trout were the first and second most targeted species by anglers.

Viavant, T. R. and J. H. Clark. 1990. Opinions and regulatory preferences of fishing license holders from the Seward Peninsula area of western Alaska. Alaska Department of Fish and Game. Fishery Data Series No. 90-20. 107 pp.

Survey results suggest that sport anglers feel that there is competition with subsistence and commercial users for fishery resources in the Seward Peninsula management area. Sport and non-catch motivated fishermen more often target non-salmon species, approved of bait restrictions, approved of catch and release fishing, were more likely to fish off the road, and rated fishing quality higher. Food motivated anglers targeted salmon, disapproved of regulations that limit or eliminate catch, fished more often on the road system, and rate fishing quality lower.

Winters, J. F. 1990. A transplant of Arctic grayling to a flooded gravel mine site in the Kuparuk River oilfield. Alaska Department of Fish and Game, Habitat Division. Juneau AK. Technical Report No. 90-4. 25 pp.

Two hundered ten Arctic grayling, captured at seven locations in the Sagavanirktok River drainage were transplanted to a flooded gravel mine site within the oil field known as Kuparuk Mine Site B, in June 1989. The purpose was to test the feasiblity of rehabilitating such sites for use by fish and wildlife. ARCO Alaska, Inc. completed a habitat enhancement project in May 1989 at Kuparuk Mine Site B that contained features that ADFG believed would increase the long-term success of the Arctic grayling transplant.

MANAGEMENT ACTIVITIES

1989 In-Season Regulatory Measures

ADFG has limited authority to rapidly enact changes in regulations without formal hearings and passage by the Alaska Board of Fisheries. Such authority is normally reserved for situations in which immediate conservation concerns for resources exist, or where opportunities to harvest an unusually abundant resource surplus to reproductive needs would be lost if no action was taken to modify existing regulations.

Emergency Orders and Regulations:

The Alaska State Legislature, in enacting AS 16.05.060, delegated to the Commissioner and his authorized designees the power to control certain aspects of public utilization of fish and game. In 1989, statutory authority for emergency orders was limited to opening and closing fishing seasons or areas. Emergency regulations, via the Administrative Procedures Act[5], were required to change quotas, bag limits, size limits or gear restrictions, among other things. Emergency orders and regulations have the same force and effect as regulations of the Boards of Fisheries and Game, or statutes enacted by the Legislature, and they carry the same criminal penalties if violated. An emergency order remains effective until rescinded, superseded by a subsequent emergency, and/or unless an expiration date is specified (ADFG 1983). Use of emergency order authority allows the ADFG to take regulatory action in response to unexpected resource scarcity or abundance. Sport fisheries in the AYK Region generally proceed under the published basic regulations. Emergency regulations expire after 120 days unless made permanent via the process outlined in the Administrative Procedures Act.

A number of regulatory changes were enacted during the 1987 calendar year, some by the emergency regulation process, the majority through action by the Alaska Board of Fisheries. A full discussion of regulation development in 1987 may be found in Arvey et al. (1991). Action by the Board of Fisheries on finfish proposals for the AYK Region is scheduled to occur only in alternate years. Consideration was given in 1987 to proposals from the region, and the next scheduled Alaska Board of Fisheries meeting to consider changes in AYK Region sport fish regulations occured in the winter of 1989-1990. Changes enacted at that time went into effect in the Spring of 1990. No emergency regulations were enacted in 1989. Only two emergency orders (Appendix B) were issued in 1989 for the AYK Region, both of which addressed the same conservation issue:

> 3-AC/DV-1-89. Closed the Kongakut River on the Arctic Slope to the retention of Arctic char/Dolly Varden from July 17, 1989 through December 31, 1989. Issued at Fairbanks, July 14, 1989.
>
> 3-AC/DV-2-89 (Clarifies the intent of 3-AC/DV-1-89). Closed the Kongakut River on the Arctic Slope to the taking of Arctic

[5] Alaska Statute 44.62.180(3)

char/Dolly Varden from July 21, 1989 through December 31, 1989. Issued at Fairbanks, July 20, 1989.

News Releases, Announcements, and Articles:

Four news releases (also called field announcements) concerning AYK Region sport fisheries were issued by the Department in 1988. They are listed below.

1. July 14, 1989. Fish and Game closes the Kongakut River on the North Slope to the taking of Arctic char and/or Dolly Varden trout. This field announcement describes the conservation concern and the emergency order which closes the fishery.

2. July 20, 1989. Fish and Game clarifies the closure of the Kongakut River to the taking of Arctic char and/or Dolly Varden trout. This field announcement corrects the wording in the 14 July emergency order.

3. October 29, 1989. American Fisheries Society honors John Clark. This news release announces the selection by the Alaska Chapter of the Society of John H. Clark, Regional Supervisor of the AYK Region, for its 1989 Meritorious Service Award.

4. December 19,1989. Arctic char are on the bite at Harding Lake. This news release describes the ADFG experimental Arctic char stocking in Harding Lake. By November of 1989, a total of 92,000 catchable and sub-catchable char had been stocked in Harding Lake. Department assessment efforts and angler reports are described.

Preseason and Post-Season Regulatory Activities

The process of developing appropriate fishing regulations continues each year both during the primary fishing seasons, as well as before and after. The following section describes the salient features of that process in 1989.

Advisory Committees:

Public input concerning regulation changes is provided by several means, including direct testimony to the Board of Fisheries and by participation in local fish and game advisory committees. Local advisory committees have been established throughout the state to assist the Boards of Fish and Game in assessing fisheries and wildlife issues and proposed regulation changes in the areas that will be affected. Most active committees meet at least once a year, usually in the fall prior to Board meetings. Advisory meetings allow opportunity for direct public interaction with Department staff who are expected to attend, answer questions, and provide clarification concerning proposed regulatory changes.

The following local advisory committees for the AYK Region have been established: (1) in Western Alaska: Central Bering Sea, Lower Kuskokwim, Central Kuskokwim, Lower Yukon; (2) in Arctic Alaska: Norton Sound, Kotzebue,

Northern Seward Peninsula, Upper Kobuk, Lower Kobuk, Noatak/Kivalina, Western Arctic, Eastern Arctic, St. Lawrence Island, Southern Norton Sound, and; (3) in Interior Alaska: Middle Nenana River, Delta, Eagle, Fairbanks, Lake Minchumina, Middle Yukon, Grayling/Anvik/Holy Cross, Koyukuk, McGrath, Ruby, Tanana/Rampart/Manley, Minto/Nenana, Upper Tanana/Forty Mile, Yukon Flats.

Several of the committees did not meet to discuss fisheries issues in 1989. Sport Fisheries Division staff participated in meetings of the Fairbanks and Delta committees in 1989. Sport fisheries issues in Nome, Kotzebue, and in the lower Yukon and Kuskokwim River areas were handled by Division of Commercial Fisheries staff attending those respective meetings.

Alaska Board of Fisheries:

The Board of Fisheries (BOF) did not meet in 1989 to consider changes in sport fish regulations in the AYK Region because of the alternating years schedule that has been adopted by the BOF.

AYK Sport Fishing Regulations:

Published regulations for 1989 are reproduced as Appendix C.

AYK SPORT FISHERIES ENHANCEMENT

Interior Alaska Lake Stocking Program

Selected waters (lakes, ponds and Piledriver Slough) of the Tanana River Valley are stocked on a continuing basis with rainbow trout, coho salmon, Arctic grayling, chinook salmon, lake trout, sockeye salmon, and Arctic char. Resulting fisheries composed a minimum of 42% of the recreational angling effort and 50% of the fish harvested in the Tanana River drainage in 1989 (Table 3). By providing stocked fish in the Tanana River valley, the ADFG hopes to:

1. ease harvest pressure on wild stocks;
2. provide increased angling opportunity for increasing numbers of anglers; and,
3. diversify angling opportunity.

Lake stocking in the Tanana River valley takes place over an approximate 130,000 km^2 area, mostly near communities and along the road system, but also in a number of remote locations accessible only by off-road vehicle (ORV), dog team, or airplane. About half of the yearly sport effort on stocked lakes takes place during the winter on larger accessible lakes.

ADFG stocking in the Interior began in the mid-1950's when barren lakes along the road system were stocked with rainbow trout or salmon. Between 1968 and the early 1980's, 15 lakes (including Birch and Quartz lakes) were chemically treated to eradicate endemic fish populations (Doxey 1987).

Throughout the 1970's, hatchery ability to provide stocked fingerlings steadily increased as fisheries enhancement received growing emphasis. Native Alaska rainbow trout brood stocks were developed when the importation of eggs from outside the state was discontinued in the late 1970's. As suitable brood stocks were developed and new hatcheries were put into production, numbers of available stocked fish increased so that by 1985, average annual harvest and effort levels for stocked waters had risen by more than 40% and 20%, respectively (Doxey 1987).

The growth and success of the interior Alaska stocking program has been largely due to the development of, and production from, Alaska state hatcheries, particularly the Clear Hatchery, located about 145 km south of Fairbanks at the Clear Air Force Station (Figure 8) and the Fort Richardson hatchery near Anchorage. The Clear Hatchery program began in 1977, with an initial mission to experimentally incubate, rear and release chum salmon to determine whether large scale enhancement of salmon would be feasible under conditions found in interior Alaska. In recent years, production of sport fish species has taken precedence over anadromous salmonids, and a large proportion of its output consists of fingerling and sub-catchable rainbow trout, coho salmon, and Arctic grayling. The facility presently has a capacity of about 9.0 million eggs.

Success of the stocking program is evaluated annually. The level of evaluation varies according to the size and accessibility of the lake and the importance and intensity of the sport fishery. Minimal evaluations address the question of whether the stocked fish survived and are providing sport fishing. More comprehensive evaluations provide limnological data, growth rate data, and fishery statistics such as CPUE, population estimates, comparison of performance between species, and other parameters.

1989 Stocking Results

Approximately 3.025 million fish of seven species were stocked in 86 different locations in 1989, of which 746,764 were rainbow trout. By comparison, 2.6 million fish were stocked in the area in 1988, of which 760,000 were rainbow trout.

Most of the stocked rainbow trout in 1989 were fingerling (approximately 1.0 g) or sub-catchable (20 to 30 g) sized fish reared at Clear Hatchery, but about 60,000 were of catchable size (65 to 135 g) reared at the Fort Richardson Hatchery in Anchorage (Table 11). All of the rainbow trout were of the Swanson River (Kenai Peninsula) strain.

Rainbow trout were stocked into Piledriver Slough for the first time in 1987, and subsequent observations and catch returns in April and May 1988 indicated that at least some large rainbow trout stocked in 1987 overwintered in, or returned to Piledriver Slough (Doxey 1989). Natural reproduction in the slough was not documented. Stockings of all three size cohorts continued in 1988 and 1989.

Approximately 1,351,392 fry-sized, fingerling, and catchable-sized Arctic grayling were stocked in area lakes, ponds, and gravel pits in 1988, all of

Table 11. Number and size of rainbow trout stocked in AYK Region waters in 1989.

Receiving Water	Number Stocked	Size (g)
Backdown Lake	600	1.1
Bathing Beauty Pond	350	1.2
Birch Lake	50,000	16.0
Birch Lake	4,045	112.0
Bluff Cabin Lake	14,000	1.0
Bullwinkle Lake	400	1.1
Chena Lake	30,481	94.0
Chet lake	800	1.1
Coal Mine #5	2,600	1.1
Doc Lake	520	1.1
Donna Lake	15,000	1.1
Donnelly Lake	6,400	1.1
Dune Lake	10,000	1.0
Earthmover Pit	800	1.1
Firebreak Lake	2,000	1.0
Forty-five point five mile Chena HSR	600	1.0
Geskamina Lake	18,000	1.0
Ghost Lake	500	1.1
Grayling Lake	1,000	1.1
Hangar Pit	1,300	1.1
Harding Lake	193,757	1.3
Hidden Lake (EAFB)	900	1.2
Hidden Lake (EAFB)	200	103.0
Jan Lake	8,800	1.2
Johnson Road Pit # 1	2,000	1.2
Johnson Road Pit # 1	500	17.0
Ken's Pond	500	1.1
Koole Lake	30,000	1.1
Les's Lake	800	1.0
Lisa Lake	10,000	1.0
Little Donna Lake	6,000	1.0
Little Harding Lake	1,000	17.0
Lost Lake	4,700	1.2
Luke Lake	1,600	1.1
Manchu Lake	2,900	1.1
Mark Lake	3,600	1.1
Monte Lake	15,000	1.1
Nickel Lake	500	1.1
North Twin Lake	2,000	1.1
Olnes Pond	1,500	1.0
Paul's Pond	500	1.1
Piledriver Slough	35,000	1.1
Piledriver Slough	8,553	25.0
Piledriver Slough	25,455	94-103

- continued -

Table 11. (page 2 of 2).

Receiving Water	Number Stocked	Size (g)
Quartz Lake	47,323	25.0
Quartz Lake	150,000	1.2
Rainbow Lake	15,000	1.1
Rapids Lake	2,000	1.1
Rockhound Lake	300	1.1
Sansing Lake	500	26.0
South Twin Lake	4,000	1.1
Spenser Lake	5,000	17.0
Spenser Lake	5,000	1.0
Thirty-one mile Richardson Pit	500	1.2
Thirty -two mile Steese Hwy Pit	1,000	1.0
Twenty-eight mile Richardson Pit	500	17.0
Weasel Lake	800	1.1
Total rainbow trout	747,084	

Moose Lake (Susitna River drainage) brood stock. These fish were incubated and reared at the Clear Hatchery (Table 12).

Arctic char stockings into the Coal Mine Road lakes were judged to be successful, and fish were expected to grow to catchable size by 1989. Growth rates of Arctic char in the hatchery were high, prompting an increase in production. Twenty-one area waters were experimentally stocked with fingerlings in the 19-22 gm size range. Harding Lake was stocked with 61,607 Arctic char (20, 110, and 739 g) in the winter, spring and fall of 1989 (Table 13). Lake trout enhancement in 1989 consisted of the experimental stocking of 56,026 fish of Paxson Lake stock, into 19 area waters to test the potential of this species for interior Alaska stocking (Table 13). They were stocked in a variety of habitats, from roadside gravel pits to small, high elevation lakes. Size of stocked fish was either about 6 g or about 20 g. Both size groups were from the 1988 brood year, but the smaller fish were stocked earlier in the summer than the larger cohort.

Chinook salmon fingerlings were stocked in area lakes in several prior years including 1988, but none were stocked in 1989. Due to spotty success, further enhancement efforts with this species have been curtailed. Harding Lake was stocked experimentally for the first time in 1988 with 500,000 sockeye salmon fry from the Gulkana Hatchery (Table 14). It was again stocked in 1989 with 515,000 post-emergent (0.16 g) sockeye salmon fry. A total of 493,055 coho salmon was stocked in Tanana Area lakes and ponds in 1989 (Table 14). Stocked coho salmon were of fingerling (4.2 g) and fry (0.27 g) size. All released coho salmon were of Wood Creek (Nenana River) stock, and all were reared at Clear Hatchery. The number of coho salmon released in 1989 represents an increase of more than two-fold over the number stocked in 1988.

Sheefish fry (109,500 at 0.99 g) were released into Harding Lake. Fry were from Clear Hatchery broodstock, originally from the Koyukuk River.

Anadromous Fish Releases by State Hatcheries

In addition to anadromous species stocked into landlocked lakes in the Tanana drainage, salmonids reared at the Clear Hatchery were stocked into flowing waters with the intent of enhancing anadromous salmon returns. Only coho salmon of the Wood Creek (Nenana River) stock were released in 1989. A total of 185,488 coho salmon of Wood Creek stock were released in the Tanana River drainage in 1988. All open water releases took place in tributaries to the Nenana River. Released salmon ranged in weight from about 2.5 to 4.2 g. The released fish were from the 1988 brood year.

The other state operated hatchery in the AYK Region was initiated in 1980 in the Kotzebue area at Sikusuilaq Creek, approximately 50 km upstream from the mouth of the Noatak River (Figure 14). The initial purpose of the facility was to examine the feasibility of large-scale chum salmon enhancement in a far northern environment. Hatchery expansion starting in 1987 is intended to bring the facility into larger scale production than in prior years of feasibility testing. Enhanced hatchery returns are intended to benefit the salmon gill net fishery which operates near Kotzebue in marine waters. The scale of salmon releases was relatively small, less than two million chum

Table 12. Number and size of Arctic grayling stocked in AYK Region waters in 1989.

Receiving Water	Number Stocked	Size(g)
Arctic grayling		
Bolio Lake	20,000	0.02
Dune Lake	5,000	2.50
Earthmover Pit	239,254	0.02
Eighty-one mile Richardson Pit	5,000	0.02
Firebreak Lake	2,000	2.50
Grayling Lake	1,000	5.40
Grayling Lake	10,000	0.02
Hidden Lake (EAFB)	1,800	5.30
"J" Lake	10,000	0.02
Johnson Road Pit # 1	1,000	5.30
Johnson Road Pit # 2	10,000	0.02
Long Pond	10,000	0.02
Otto Lake	712,112	0.02
Round Pond	10,000	0.02
Twin Bears (Chena Hot Sprs. Rd.)	650	3.10
Walden Pond	350	3.10
Steese Hwy Pits:		
Mi. 29.6	500	3.10
" 30.6	125	3.10
" 33.0	750	3.10
" 33.5	500	3.10
" 34.6	400	3.10
" 35.8	300	3.10
" 36.8	125	3.10
Chena Hot Springs Rd Pits:		
Mi. 32.9	310	3.10
" 42.8	1,000	3.10
" 45.5	500	3.10
" 47.9	400	3.10
Total Arctic grayling	1,043,076	

Table 13. Number and size of Arctic char and lake trout stocked in AYK Region waters in 1989.

Receiving water	Number Stocked	Size (g)
Arctic char		
Backdown Lake	126	22.0
Bathing Beauty Pond	125	19.0
Brodie Lake	300	22.0
Chena Lake	2,498	143.0
Dick's Pond	200	22.0
Doc Lake	100	22.0
Grayling Lake	260	19.0
Harding Lake	12,635	20.0
Harding Lake	47,087	110.0
Harding Lake	1,885	739.0
Hidden Lake	630	19.0
Ken's Pond	100	22.0
Last Lake	589	22.0
Little Harding Lake	1,260	19.0
Lost Lake	1,640	19.0
Manchu Lake	1,000	19.0
North Weigh Station Pond	350	19.0
North Weigh Station Pond	250	143.0
South Weigh Station Pond	350	19.0
South Weigh Station Pond	250	143.0
32.9 mi. Chena Hot Springs Rd. Pit	110	20.0
28 mi. Richardson Hwy. Pit	280	19.0
31 mi. Richardson Hwy. Pit	630	19.0
30.6 mi. Steese Hwy. Pit	50	20.0
36.8 mi. Steese Hwy. Pit	50	20.0
Rangeview Lake	350	22.0
Subtotal Arctic char	73,105	
Lake trout		
Bathing Beauty Pond	350	6.3
Bullwinkle Lake	400	6.3
Chet Lake	800	6.3
Coal Mine Pond #5	2,600	6.3
Ghost Lake	500	6.3
Grayling Lake	1,000	6.3
Grayling Lake	550	20.0
Hidden Lake	600	20.0
Lost Lake	4,700	6.3
Lost Lake	1,500	20.0
Nickel Lake	500	6.3
Paul's Pond	1,000	6.3
Rockhound Lake	300	6.3
Sheefish Lake	800	6.3
Silver Fox Pit	1,200	6.3
Silver Fox Pit	350	20.0
Triangle Lake	10,000	6.3
47.9 mi. Chena Hot Springs Rd. Pit	400	6.3
29.6 mi. Steese Hwy Pit	500	6.3
34.6 mi. Steese Hwy Pit	400	6.3
Summit Lake (Parks Hwy)	2,000	20.0
West Twin Lake	25,576	20.0
Total lake trout	56,026	

Table 14. Number and size of coho salmon, sheefish and sockeye salmon stocked in AYK Region waters in 1989.

Receiving water	Number Stocked	Size (g)
Coho Salmon		
Birch Lake	40,000	4.2
Chena Lake	15,000	4.0
Dead Dog Pit	216,845	0.3
Dune Lake	10,000	4.1
Earthmover Pit	1,000	4.2
Eight Mile Lake	5,000	4.2
Geskakmina Lake	10,000	4.1
Hangar Pit	2,600	4.2
Johnson Road Pit # 1	500	4.2
Long Pond	700	4.2
Lost Lake	4,700	4.2
Manchu Lake	2,900	4.2
Moose Lake	10,000	4.2
Otto Lake	20,000	4.2
Quartz Lake	150,010	4.1
Round Pond	400	4.2
Sansing Lake	200	4.2
28 Mile Richardson Hwy. Pit	1,600	4.2
31 Mile Richardson Hyw. Pit	1,600	4.2
Sockeye Salmon		
Harding Lake	500,000	fry
Sheefish		
Harding Lake	109,503	1.0
Subtotal: coho salmon	493,055	
sockeye salmon	500,000	
sheefish	109,503	

salmon fry prior to 1988. Returns from prior year releases have been identified both in the commercial fishery and at the hatchery. Releases of chum salmon fry in the lower Noatak River in 1989 totalled 6,052,000 fish at an average size of approximately 0.5 g. Returns in 1989 of about 22,000 adult chum salmon were identified in the commercial fishery harvest and at the hatchery site from hatchery releases in 1984-1986. Expanded hatchery capability was initiated in 1987 with the installation of new egg and fry incubators in order to increase rearing capacity to 10 million eggs. In addition, new raceways were installed to allow short term rearing of fry before release.

LAND USE, HABITAT AND WATER QUALITY

Habitat-Related Fisheries Issues

Commercial development of minerals and timber, and construction of highways, can have significant impacts on watersheds as well as fish. The following is a brief description of the types of commercial development in the Tanana and AYK Areas, and known fisheries impacts.

Placer Mining:

The majority of Alaska's placer mining takes place in the AYK Region. Placer mining effluents, if not controlled, have the potential to significantly alter stream habitats and to impact fish populations. Elevated stream turbidity and sediment loads may reduce oxygen exchange rates through abrasion of gill tissues, prevent foraging by sight feeding fishes, limit aquatic plant growth by displacement or smothering, and generally reduce abundance and/or diversity of aquatic macroinvertebrates important for fish production (Weber 1986). Placer mining activities may also increase the toxic metal content (arsenic, mercury) of stream water (ADEC 1986). In addition to changes in water quality, placer mining can affect the physical characteristics of the streambed by altering channel flow and modifying riparian habitat. Tailing deposits can inhibit fish passage and decrease overwintering habitat.

In Alaska in 1989, 5,592 new mining claims (on state and federal lands) were recorded by the Alaska Department of Natural Resources (ADNR), a receiving agency for state and federal mining permits (Bundtzen et al. 1990). The number of claims recorded in 1989 represents a decrease of 53% from the number recorded in 1988. The total number of active claims on file in 1989 (69,715) was fewer than the number of claims on file in 1988. The ADFG issues permits for mining in streams supporting anadromous and resident fish per its Alaska State Statute Title 16 authority. In some cases, where development is within a stream supporting only non-anadromous fish and will not block fish passage, or where fish are not present, permits may not be required.

Gold production increased in 1989 for the third straight year from 8,241 kg (265,000 troy oz) in 1988 to more than 8,852 kg (284,617 troy oz) in 1989 for the entire state (Green et al. 1989, Bundtzen et. al. 1990). The majority of the gold operations were placer mines (217), with the remainder (5) consisting

of lode operations. Placer mining accounted for 87% of the gold produced in 1989.

The U.S. Environmental Protection Agency (EPA) issued placer mining effluent guidelines in 1988, which had been under consideration since 1986. Guidelines for water discharge permits went into effect in 1989 requiring 100% recycling of mine process waters, in addition to placing certain restrictions on the use of hydraulic mining technologies. Certain "best practice" mining methods are recommended in the guidelines.

The Alaska legislature implemented rental and royalty fees from all mining on state land in reponse to an Alaska Supreme Court decision that the Alaska Statehood Act required collection of these fees from mining activity on state lands.

Gravel Mining:

There are few documented instances where gravel mining in AYK has affected fish populations. Gravel mining of a streambed has the potential to cause instream fanning, erosion, and deterioration of water quality and fish habitat (ADEC 1986). A complete listing of gravel mining sites and impacted streams is available in ADEC (1986). Bundtzen et al. (1990) contains a listing of gravel mine operations in 1989. Reclamation of 19 gravel mine pits in the Prudhoe Bay area of the North Slope has increased overwintering habitat for fish inhabiting connecting streams, and increased fish production (Hemming 1988 and 1990).

Statewide production of sand and gravel in 1989 was at the lowest level since the early 1970's due to declines in major construction activities.

Industrial Metals Development:

Offshore dredging for gold in Norton Sound by the 'Bima' (world's largest bucketline dredge owned by Western Gold Exploration and Mining Co.) was conducted from 9 June through 11 November 1989 (110 days of actual operation) and recovered 953 kg (30,661 troy oz) of refined gold. Environmental effects of this operation on nearshore habitats and fisheries in the Nome area have been monitored by industry consultants, and the results of monitoring efforts are reviewed by agencies at regular intervals.

Construction activities at the Red Dog Mine in the headwaters of the Wulik River north of Kotzebue continued on the mill, ore body and port facility. Cross drainage structures on the road were also repaired Pre-production stripping of the ore body began in August 1989, and milling operations began in November. Because of heavy rains in the area, water filled the facility tailings impoundment and water was siphoned into the creek to slow the rate of filling. In the fall, red-orange-colored precipitates were noticed in Ikalukrok Creek, from its confluence with Red Dog Creek to its downstream junction with the Wulik River. Water samples collected in Ikalukrok and Red Dog creeks showed elevated concentrations of zinc. The discharge of heavy metals and the precipitates were traced to ground seeps immediately downstream of the ore body and on Red Dog Creek, where saturated terrain apparently

leached the concentrates into the creek. Cominco-Alaska Inc. developer of the zinc deposit, requested authority in the fall to discharge untreated water from the tailings impoundment pond into Red Dog Creek to avoid breaching the earthen dam due to high runoff from summer rains. The permit was denied by ADFG and the Alaska Department of Environmental Conservation. A water treatment plant designed to remove heavy metals, operating downstream of the impoundment was under final construction during the last months of 1989. There was concern in the fall of 1989 that heavy metal contamination of Red Dog and Ikalukrok creeks would occur both from natural leaching of the ore body as it was stripped for ore production and from discharge of impounded waters that were not treated to remove contaminants. Such contamination would affect fish resident to, and migrating through, the lower Wulik River, resulting in public health concerns for the river fisheries for char, Arctic grayling and salmon.

Oil and Gas Development:

Oil and gas extraction activities in the AYK Region are presently restricted to the North Slope. North Slope development has affected fish habitat on and near transportation corridors (such as the Dalton Highway and the Trans Alaska Pipeline) and by the extraction of gravel for road and building construction and maintenance. There is evidence that construction of Prudhoe Bay's West Dock Causeway has disrupted east and west migratory movements as well as recruitment of Arctic cisco in the Colville and Sagavanirkok rivers (Gallaway et al. 1987; Moulton et al. 1986). Documentation of oil spills and resulting adverse impacts (if any) on fish populations from contamination is lacking in the AYK Area. A number of studies throughout the 1980's have tried to determine or predict impacts from offshore gravel causeways, such as the Endicott Causeway, in the Beaufort Sea to fish, fisheries and fisheries habitat.

Timberland Development:

Logging had no significant impact to fisheries resources in the AYK Region in 1989. Little commercial logging presently occurs in the region. The largest commercial timber harvests in the Kuskokwim Basin occur from McGrath to Stony River (ADNR 1988). Some commercial logging of spruce currently occurs in the Tanana River basin, primarily on state owned land along the Tanana River.

Road construction associated with logging could impact fish populations by accelerating the rate of soil erosion and sedimentation in streams, however, because of the minimal level of industry development at the present time, no such problems have been identified in the region.

Highway Development:

Roads allow increased access to streams and lakes, thereby increasing the utilization of sport fishery resources. Improperly designed or constructed road culverts can create partial or complete barriers to fish migration. Major highways in the AYK Region include the Steese Highway which provided road access via Fairbanks to the Yukon River and Birch Creek; the Taylor Highway leading to the Forty-Mile and Yukon rivers; the Parks and Richardson

highways which provide access to the Tanana River and many of its tributaries and lakes; the Dalton Highway to the North Slope which crosses the Yukon River, upper tributaries of the Koyukuk River and the Sagavanirktok and Kuparak rivers on the North Slope. A newly-constructed road north of Kotzebue connects the Red Dog Mine in the headwaters of the Wulik River to the Chukchi Sea coast south of Kivalina. Its purpose is to serve the Red Dog Mine site, and for transport of ore to the port facility on the coast. The Seward Peninsula has three major roads which cross more than a dozen rivers important for sport fishing. Of the road systems in the AYK Region, culvert crossing on the Dalton, Red Dog Mine and Seward Peninsula Highways have been of most concern to the Department. There are 40 - 50 culverts on the Seward Peninsula built in the 1950's of which many constitute partial barriers to tributary spawning and rearing. Habitat Division personnel, the Alaska Department of Transportation, and Bureau of Land Management (BLM) personnel have worked cooperatively to improve stream habitat by removing gravel berms in the Nome and Pilgrim rivers which will provide more rearing habitat for young Arctic grayling.

Commercial Utilization of Fisheries Resources

Commercial sport fishing activities, through establishment of lodges and guiding services, offer a source of revenue to residents in the Tanana and AYK Areas. A brief description of known commercial uses of sport fish species follows.

Wilderness Lodges and Guiding:

Lodges and sport fish guiding operations (including outfitters) are significant factors in the utilization of sport fishery resources in the AYK Region, although the extent of this influence has yet to be fully determined. More information regarding the location and operation of lodges and guiding and outfitting operations is needed. A partial list of the type of operation at various locations can be found in Appendix D. The number of resident or nonresident clients served, species targeted, or types of fishing experiences offered at these locations is presently incompletely documented.

Commercial Fisheries:

Important commercial fisheries exist for finfish and shellfish species in the AYK Region. The largest is the commercial salmon fishery, which in 1989, had a wholesale value of approximately $16.4 million. The herring and shellfish fisheries produced approximately $3.5 million and $1.2 million worth of product in 1989 (Savikko and Page 1990).

Commercial fisheries for finfish species other than salmon, or herring, are sometimes allowed under authority of a permit issued by the Commissioner of the Department of Fish and Game or his designee, usually an area manager of the Division of Commercial Fisheries. Permits to commercially harvest whitefish, sheefish, northern pike, blackfish *Dallia pectoralis*, lamprey *Lampetra japonica*, Dolly Varden and burbot are issued occasionally for limited (usually local) commercial markets. In many cases, permits are issued by the Department, but harvests are either not made or are not reported. Only a

small commercial harvest of non-anadromous freshwater finfish was reported for the AYK Region in 1989. The Division of Commercial Fisheries maintains data records of such harvests.

Commercial harvests of freshwater species in the Norton Sound and Kotzebue Area in 1989 are reported by Bue (pers. com.). Historical harvests are summarized in Merkouris and Lean (1989). The harvest of sheefish from Hotham Inlet near Kotzebue takes place during winter months of two calendar years (winter of 1988-89, and fall of 1989). Commercial harvest during calendar year 1989 is estimated to total 2,387 fish. Eight catcher-sellers participated in the fishery, harvesting 7,756 kg (17,085 lbs). This fishery is limited by quota to 11,350 kg. Adult Dolly Varden taken incidentally in the Kotzebue commercial chum salmon fishery are sometimes sold to commercial fish processors. A total of 3,093 such fish were harvested and sold in 1989. The mean weight of the commercially sold Dolly Varden was 2.98 kg (6.6 lbs) in 1989. Virtually no fishing activity under the authority of a freshwater fishing permit took place in either the Norton Sound or Kotzebue Areas in 1989 for the harvest of whitefish or other freshwater species such as burbot or northern pike. A single permit was issued to a fisherman in Unalakleet for the harvest of char, and a reported approximate 200 char were harvested.

Francisco et al. (1990) reports that in 1989, seven fishermen harvested and sold 178 whitefish and 282 burbot in the Kuskokwim Area.

A fishery has taken place in the Colville River since 1964 for broad whitefish, humpback whitefish, Arctic cisco and least cisco. Reported harvests in this fishery in 1989 include: 71 broad whitefish; 6,575 humpback whitefish, 17,877 Arctic cisco, and 23,303 least cisco (Holder 1991). Recorded harvests of humpback whitefish in this fishery in both 1988 and 1989 were well above those of any previous year, but harvests of other species in 1989 were within the historical range.

Freshwater fishery permits have been issued in various years for whitefish at Healy Lake, whitefish in Lake Minchumina, and burbot in the Tanana River. A total of five permits for commercial harvest of freshwater finfish was issued in 1989 for the Yukon River drainage. Only one of the permit holders reported taking any fish under the permit issued. A reported 2,010 lbs of whitefish (species not specified) was harvested in the Yukon River downstream of Tanana (Holder 1991). There were no permits issued or reported sales of freshwater species in the lower Yukon River in 1989.

Land Withdrawals, Status, and Planning

Land use designations by private owners, state, or federal agencies may affect fisheries management considerations within given land parcels. A brief description of various national land designations in the Tanana and AYK Areas and known influences on the use of sport fish within land units follows.

ANILCA:

The Alaska National Interest Lands Conservation Act (ANILCA), enacted into law in 1980, completed the implementation of the Alaska Native Claims Settlement

Act (ANCSA) and addressed outstanding issues such as subsistence opportunity, energy development, economic growth and transportation planning. Legislative solutions to these issues included the creation or expansion of five national conservation systems in Alaska: national parks, wildlife refuges, wild and scenic rivers, wilderness preservation lands and national forests.

The purpose of ANILCA is to preserve for future generations certain lands and waters in Alaska, protect resources related to subsistence needs and the subsistence lifestyle for rural residents, and to protect those resources related to recreational opportunities, such as sport fishing and hunting (ANILCA 1980). The Act directs specific management guidelines for conservation system units within Alaska.

To maintain state responsibility for fish and game management on newly designated conservation system units, the ANILCA required the state to distinguish between user groups and assign priority opportunities for subsistence uses of fish and game resources.

National Parks, Monuments and Preserves:

All National Park Service (NPS) managed lands in the AYK Region are discussed under the following section.

A memorandum of understanding exists between the State of Alaska and the National Park Service (NPS) which stipulates that State fish and game regulations apply on NPS lands except when a more restrictive harvest approach is desired by NPS. NPS may promulgate regulations concerning consumptive uses of resources which are more restrictive than state laws. The ANILCA intends for NPS to provide opportunities for continued subsistence and traditional activities.

Park land designation has some influence on utilization of the sport fishery resource by restricting types of development within the parks. Large scale commercial development (ie. fishing lodges) is not allowed, but small lodge facilities for a few guests have been allowed in Kobuk National Park. Construction of temporary facilities (such as fish camps or tents) on park lands in Alaska was granted under ANILCA, but has been the subject of dispute with NPS. NPS goals include minimizing the sport fish take by encouraging release of captured fish or the taking of only small individuals of the more abundant species (NPS 1985a, 1986a). Motorized boat, snow machine, and airplane access is allowed for sport fishing on park lands in Alaska. Fish stocking or enhancement activities can be allowed if the purpose is to restore fish populations to "natural or healthy" levels.

Conservation system units within AYK (Figure 20) are as follows:

1. Kobuk Valley National Park is 688,000 ha (1,700,000 ac) in size and includes one wild and scenic river and 77,000 ha (190,000 ac) of wilderness. NPS has proposed an additional 168,000 ha (414,720 ac) be set aside as wilderness. Regional residents account for more than 90% of park use. NPS estimates that out-of-region recreational use is limited to about 25-75 users per year. Most out-of region

visitors fly in their own planes to sport fish at the mouth of the Salmon River and other tributaries of the Kobuk River. Local boats can be chartered for fishing. Lodges in Ambler and Shungnak accommodate a small number of visitors. There are reported instances of subsistence and sport fish user conflicts on the Kobuk River (see NPS 1986a).

2. Gates of the Arctic National Park and Preserve consists of 2,939,000 ha (7,263,000 ac) of combined park and wilderness lands and 42,000 ha (103,932 ac) of park lands only. The park also includes six wild and scenic rivers. Recreational fishing is mostly for Arctic grayling, Dolly Varden and lake trout, with the most heavily used areas being Walker and Chandler lakes. Two lodges on Walker Lake, at the headwaters of the Alatna River, advertise sport fishing opportunities, and local air-taxi operators drop off anglers at other areas. Sport fishing mostly occurs in conjunction with other activities such as river running, hunting and backpacking (see NPS 1985a).

3. Cape Krusenstern National Monument was created in 1980 to protect archaeological sites, preserve prehistoric and historic Native cultures, protect habitat for fish and wildlife and protect the viability of subsistence resources. The NPS directs management of the monument which is 267,000 ha (659,807 ac) in size. Access and development restrictions of park lands apply to monument lands. Fishing for whitefish, ciscoes, Arctic char/Dolly Varden, chum salmon and northern pike is primarily by subsistence users. Recreational use of the monument is extremely limited and occurs mostly in conjunction with subsistence activities (NPS 1985b).

4. Noatak National Preserve is 2,630,000 ha (6,500,000 ac) in size, and includes one Wild and Scenic River and 2,350,000 ha (5,800,000 ac) of designated wilderness land. It is also a UNESCO Biosphere Reserve, designed to maintain genetic pools. Recreational use is estimated at 2,000 to 2,500 visitors per year, who participate in river excursions, hunting and sport fishing. Arctic grayling and Dolly Varden are the most common sport fish. About 25 commercial operators provide air and guiding service. Popular drop off points for sport fishing include the Kelly and Cutler Rivers. Construction of a State hatchery (Sikusuilaq Creek) in the Lower Noatak River has caused some concern on the part of NPS regarding maintenance of the chum salmon gene pool as expressed in the Biosphere Preserve philosophy (NPS 1986b).

5. Bering Land Bridge National Preserve consists of 1,127,000 million ha (2,800,000 ac), with 90% of use related to subsistence and local use activities. NPS has proposed that an additional 121,000 ha (299,520 ac) of the Preserve be designated as Wilderness. Very little sport fishing occurs in the Preserve because better fishing opportunities are available on the Seward Peninsula outside of the Preserve (NPS 1986c).

6. Yukon-Charley Rivers National Preserve is 1,023,000 ha (2,530,000 ac) in size and includes the Charley River and its main tributaries as a Wild and Scenic River. NPS has proposed that 442,380 ha (1,093,120 ac) be designated as Wilderness. Sport fishing is primarily for Arctic grayling, with northern pike found in lower tributary streams and Dolly Varden found in one tributary (NPS 1985c).

A General Management Plan for each unit (except the Yukon-Charley River National Preserve which was completed in 1985) was completed by the NPS in 1987 after taking public and state agency input. General Management plans are intended to establish management direction, determine public access policies, and allowable public uses including priorities for fisheries research within each park unit. It is intended that supplemental plans will be developed in subsequent years to deal with specific fisheries projects, public uses, and access problems. Many such planning efforts were underway in 1989.

National Wildlife Refuges:

Refuges (Figure 20) are mandated to conserve fish and wildlife habitat, fulfill international treaty obligations, provide for continued subsistence opportunities and ensure water quality. Each refuge has specific legislative purposes and although each is regulated by federal law, the USFWS recognizes a master memorandum of understanding with the State of Alaska which vests primary responsibility for fish and wildlife management with the state, unless subsistence opportunities are compromised. Refuge managers review and adopt ADFG management plans unless the plans are formally determined to be incompatible with the purposes of the refuge. Different management goals exist for each refuge. Policy ranges from that of minimal interference with human use, to that of promotion of increased Wilderness and Wild and Scenic River designations. All guides and outfitters are required to have special use permits in addition to state licenses (for big game guides). There are seven National Wildlife Refuges (NWR) in the AYK Region, and a summary of each follows. Comprehensive Conservation Plans (available from U.S. Fish and Wildlife Service) were completed for all refuges except the Yukon Delta NWR and Arctic NWR in 1987. The plans contain detailed information on the environment, management alternatives, environmental consequences as well as maps for each unit. Step-down plans, more specific plans for fisheries, river management and other public uses of the lands and their resources, will be completed in subsequent years.

1. Selawik NWR is 890,327 ha (2,200,000 ac) in size and includes one Wild and Scenic River and 97,126 ha (240,000 ac) of Wilderness lands. The preferred management alternative is for minimal interference. Mechanized travel to any inholdings, oil and gas studies and recreational opportunities would be allowed. Recreational use levels are extremely low, with most sport fishing targeting on sheefish in the Kobuk River, adjacent to the NWR (USFWS 1986).

2. Yukon Delta NWR is the largest of Alaska's 16 refuges and consists of 10.52 million ha (26,000,000 ac) including two Wild and Scenic

Rivers and 769,000 ha (1,900,000 ac) of Wilderness lands. The management plan permits oil and gas leasing on only 3% of the refuge. Habitat and population manipulation may be conducted on some of the lands. Most sport fishing occurs on the Kisaralik River, but increasing interest from Togiak River fishing guides in establishing commercial guiding on the Andreafsky and Kwethluk rivers and other refuge rivers has been expressed. Rainbow trout are found in the Kwethluk, Kasigluk, Kisaralik, Tuluksak, and Aniak rivers. Sport harvest of sheefish has increased and large numbers of northern pike are caught by locals in the winter. If sport fish guiding increases, the refuge staff envisions conflicts with subsistence users and plans to launch an extensive monitoring program (USFWS 1987a).

3. Yukon Flats NWR is 4,530,000 ha (11,200,000 ac) in size, has two Wild and Scenic Rivers, and borders the Trans-Alaska pipeline. The management plan directs minimal disturbance of habitat and increased wilderness land designations. Limited fly-in sport fishing exists and is mostly incidental to hunting and river running. The Dall River receives the heaviest sport fishing pressure, due to access from the Dalton Highway (USFWS 1985).

4. Koyukuk and Innoko NWR are 1,820,000 and 283,000 ha (4,500,000 and 700,000 ac) in size, respectively. The management plan calls for minimal management. Staff has little information on sport fishing, but believes some occurs in conjunction with hunting and river running (USFWS 1987c).

5. Nowitna NWR consists of 809,389 ha (2,000,000 ac) and one Wild and Scenic River. The management plan is for minimal management. Sport fishing for trophy sheefish is an established activity on the Nowitna River. Northern pike are also sought by anglers. It is believed that most sport fishing occurs in conjunction with hunting (USFWS 1987b).

6. Kanuti NWR is 647,511 ha (1,600,000 ac) in size. The management plan emphasizes the restoration of fish populations to natural and healthy levels. The plan also strives to increase fishing opportunities, but would designate no wilderness areas, and would allow some oil and gas studies (USFWS 1987d).

7. Arctic NWR consists of 7,900,000 ha (19,500,000 ac), four Wild and Scenic Rivers and 3,240,000 ha (8,000,000 ac) of wilderness lands. Section 1002 set aside 607,000 ha (1,500,000 ac) of land on the coastal plain of ANWR for future oil and gas exploration and development pending authorization by the U.S. Congress. The management plan maintains the existing range and intensity of management and recreational economic uses. Opportunities for fishing and other public uses would be maintained, as would scientific research. Most sport fishing for Arctic grayling, Dolly Varden, Arctic char, lake trout and northern pike occurs in conjunction with river trips and hunting (USFWS 1988).

Float trips on refuge rivers of both the north and south slope are a recognized and growing popular use. The Kongakut River on the north slope is considered most popular, followed by the Hulahula and Canning rivers. The Ivishak and Sagavanirktok rivers are also sometimes used by float parties. The Sheenjek and Porcupine rivers are the most popular rivers on the Brooks Range south slope for recreation (USFWS 1988).

Wild and Scenic Rivers:

In the AYK Region, 23 rivers in national parks, preserves and refuges have been placed within the national wild and scenic river system. The Wild and Scenic Rivers Act of 1968 stipulates that these rivers shall be preserved in free flowing condition, generally free of impoundments, and have primitive shorelines and watersheds. The wild and scenic river designation positively impacts utilization of the sport fish resource by affording anglers the possibility of a pristine and uncrowded fishing experience. Access to rivers is controlled and facilities are restricted, thus potentially precluding the development of fishing lodges among other uses. Wild and scenic rivers in the AYK Area are listed in Appendix A.

Wilderness Land Designations:

The Wilderness Act of 1964 restricts modes of access and development on designated parcels of land. Wilderness land designation is intended to promote solitude and primitive recreational opportunities. Depending upon interpretation of the wilderness modifications in ANILCA, land managers may restrict the use of power chain saws, generators, and other similar motors. Stream clearance, weir construction, and field camp operations in wilderness areas in support of fisheries field research may be restricted, depending upon circumstances[6].

Natural Factors Affecting Sport Fisheries

The timing and severity of natural catastrophic events may affect sport fish habitat and life history. Known natural occurrences in 1988 are described and their impacts on sport fish are estimated in the following paragraphs.

Fires:

Fires and fire suppression measures by agencies such as the BLM and State of Alaska, Division of Forestry, are common during the summer months; and, during particularly dry and warm years, forest and tundra fires are a major feature of the climate in Interior and Northern Alaska. Fires in Alaska generally do not penetrate the duff layer to mineral soil and thus do not represent a great potential erosion problem. In addition, frozen ground in large areas of the Arctic and Interior assists in curtailing fire-induced soil erosion. Major impacts of fire on fisheries can occur with the use of earth moving equipment by firefighters to prevent enlargement of a blaze, and aerial deployment of

---

[6] Artina Cunning. 1988. Personal Communication. ADFG, Division of Wildlife Conservation, PO Box 1148, Nome, AK 99762.

fire retardant. BLM has strict guidelines regarding fire retardant use near water bodies. BLM personnel state that the retardant presently in use is biodegradable and if mistakenly introduced into a water body, would have minimal and short-lived impact on fish populations[7]. Thus, it is the BLM position that fire retardant use in Alaska does not directly threaten fish populations.

The 1989 fire season was much less severe than that of 1988 when a total of 602 unique statewide fire numbers were assigned by the Alaska Fire Service (AFS) (U.S. Department of Interior/Bureau of Land Management Alaska Fire Service. 1989). By contrast, 485 fire numbers were assigned in 1989, and only 27,880 ha (68,893 ac) were burned A total of 850,5000 ha (2,100,000 ac) burned in 1988, compared to the 5 year average 82,248 ha (203,171 ac) .

Snow Pack Assessment:

Snowpack depth and duration impacts fish life history by influencing such factors as water level, sunlight penetration, and insulation of water bodies in periods of extreme cold. Snow survey data obtained from the Soil Conservation Service (USDA 1989) provided snowpack summaries for water year 1989 by region. (Water year 1989, hereafter referred to as WR 89, is the period of time from 1 October 1988 through September 30, 1989).

In the Arctic, winter snow accumulation was above average as of May, 1989. In the Upper Yukon Basin, the basin-wide snowpack at the headwaters of the Yukon River was well below average in May because of early melting. Maximum snow water equivalent (SWE) was reached in April at about 15.2 cm, while SWE in the Central Yukon peaked in April at about 7 cm and was below normal. Breakup was earlier than normal in the Tanana Basin, where the SWE was about 10.7 cm in April compared to the average of about 10 cm. In the Koyukuk and Lower Yukon Basin areas SWE was above average, with a SWE of 14.7 cm and air temperatures from February through April were well above average. In the Kotzebue-Norton Sound Basins, snowfall levels were greater than normal. Kuskokwim area winter snowfall was well above normal, with SWE of 23.0 cm in April, compared to average values of 15.2 cm.

Stream Discharge Assessment:

Stream flows have a significant impact on fish life history, especially maximum stream discharge events. Stream discharge records obtained from the U.S. Geological Survey (Lamke et al. 1990) provide monthly and annual mean and extreme discharge values by river (Table 15).

Of the streams in the AYK Region for which discharge data are collected, many of the sites throughout the region recorded mean discharge rates in WR 89 that exceeded the annual mean discharge of all years of record (Table 15). However, maximum discharges, with the exception of the Kobuk River near Kiana, did not approach the maximum recorded flows. Maximum discharges at all sites in WR 89 did not exceed maximum flow in the years of record. No serious

---

[7] Mark Jones. 1988. Personal Communication. BLM, Alaska Fire Service, PO Box 35005, Ft. Wainwright, AK 99703.

Table 15. Gaging station records[a] of mean and maximum discharge[b] for 1989, and mean and maximum discharge for the period of record, for 10 rivers in the AYK Region.

River	1989		Period of Record		
	Mean	Max	Mean	Max	Years
Kuskokwim at Crooked Cr	44.9	149.0	40.9	392.0	1951-89
Yukon at Eagle	73.4	224.0	83.1	545.0	1950-89
Yukon at Pilot Station	225.5	800.0	223.5	1,100.0	1975-89
Tanana at Fairbanks	22.5	84.8	19.8	96.4[c]	1973-89
Chena at Fairbanks	1.2	8.9	1.4	74.4	1948-89
Salcha near Salchaket	1.3	20.1	1.6	97.0	1948-89
Snake near Nome	0.3	3.0	0.2	4.2	1965-89
Kobuk near Kiana	22.4	151.0	15.3	152.0	1976-89
Wulik near Kivalina	1.8	31.4	1.0	31.4	1984-89
Kuparuk near Deadhorse	2.1	70.0	1.4	118.0	1971-89
Sagavanirktok, Pump 3	1.6	11.5	1.3	23.0	1982-89

[a] Data from Lamke et al. 1990.
[b] Cubic feet per second x 1,000.
[c] Flood of Aug. 16, 1967 reached an approximate discharge of 125,000 ft^3

flooding and streambed disruption was noted during the summer of 1989 in any AYK Region drainage.

Mean Air Temperature and Precipitation:

Average annual temperature and precipitation regimes influence the timing of stream freeze-up and break-up occurrences, and by affecting the duration and severity of the seasons, plays a major role in the annual water budget. Climatological data for four cities in the AYK Region (Fairbanks, Nome, Kotzebue and Barrow) were obtained from the US Weather Service (NOAA 1989). The mean monthly and yearly temperature (F) and precipitation (inches) for the period of record (1958-1989) are provided by this source. Climatological data from only four locations may not adequately represent micro-climatic conditions throughout the region, but may provide an indication of seasonal weather patterns in the AYK Region.

Mean monthly air temperatures in WY 1989 for the four cities were generally slightly elevated over the historic means. In northern (Barrow) and northwest Alaska (Nome and Kotzebue), a distinct midwinter rise in temperature was noted in February 1989 (Figure 25).

Mean monthly precipitation values for WY 1989 for the four cities are much more variable than temperature means. The interior, as judged from the precipitation records from Fairbanks, experienced near average moisture from October 1988 to April 1989, and then experienced higher than average precipitation in May and June 1989. Higher than normal precipitation was recorded in July and August 1989 in Barrow, Nome and Kotzebue (Figure 26).

ACKNOWLEDGEMENTS

The author thanks John H. Clark for his continued support and generous help in preparation of this report series. The author is grateful to members of the staff, including Mike Mills, Mike Doxey, Robert Clark, Margaret Merritt, Fred Andersen, Jerry Hallberg, John Burr, and Fred DeCicco for responding generously to requests for assistance. Thanks also to Sara Case for final preparation of the report, and to Carol Hepler for preparation of several maps.

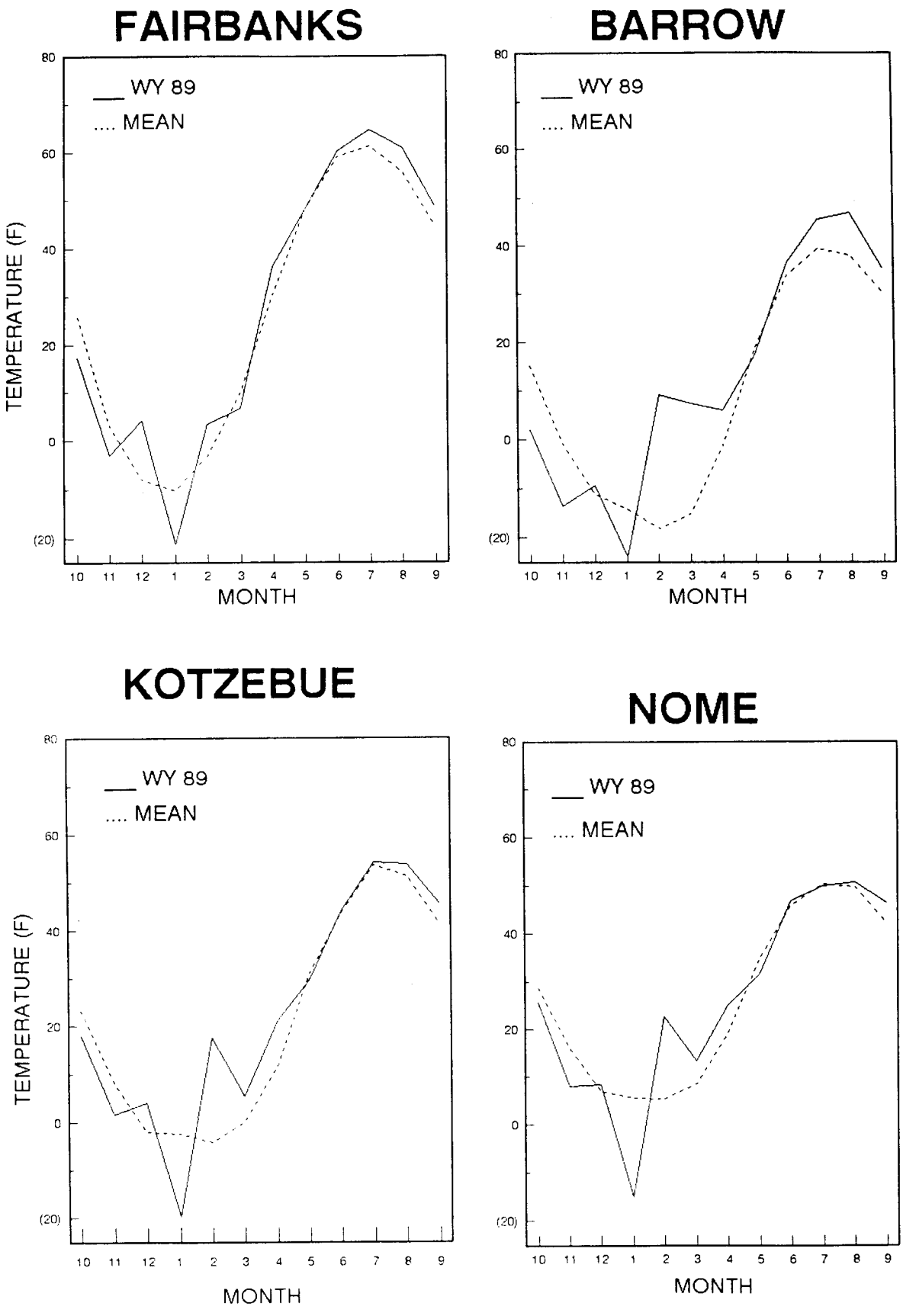


Figure 25. Monthly mean air temperature for the 1989 water year compared to monthly mean air temperature, 1958-1989, in four AYK locations.

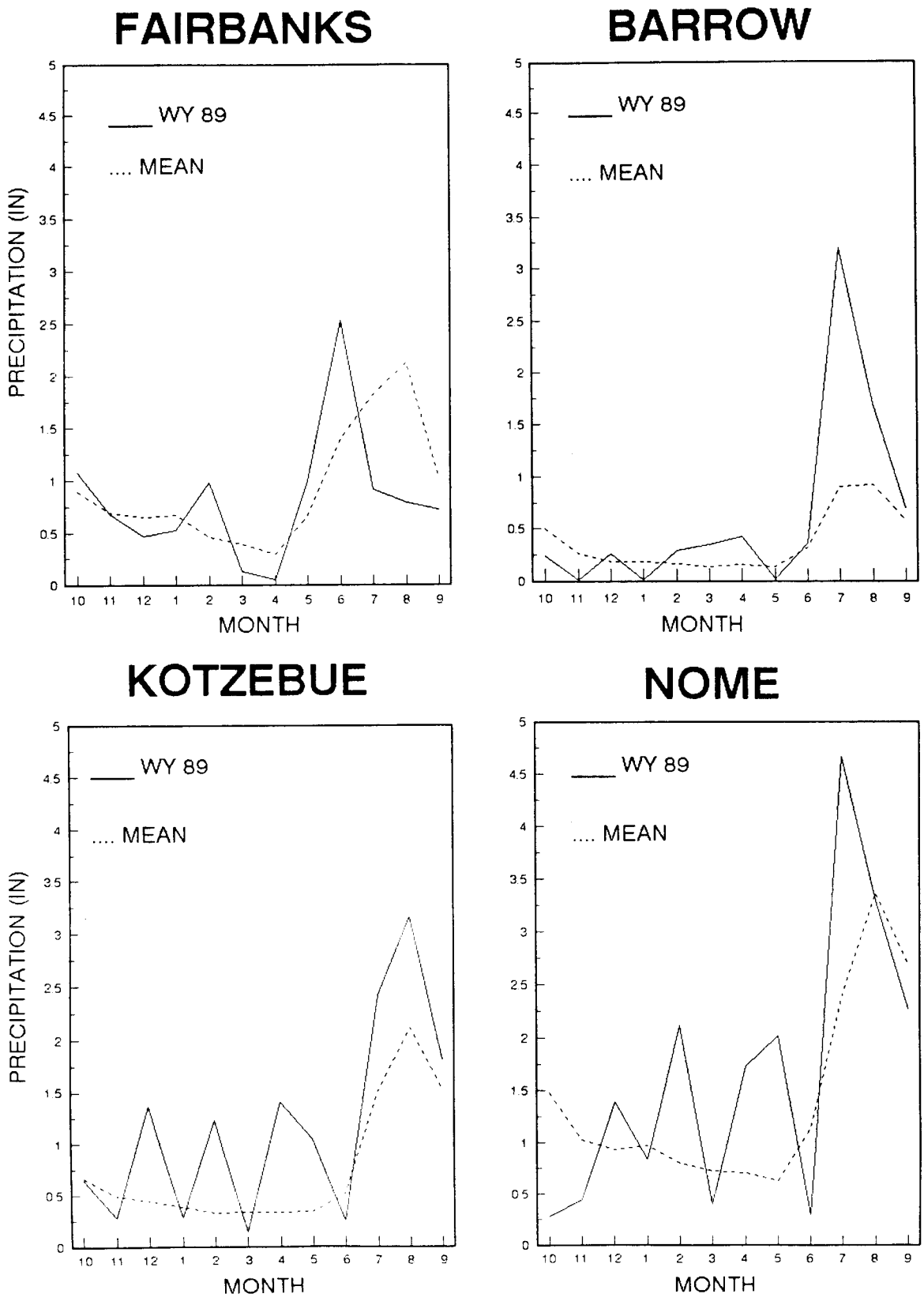


Figure 26. Mean monthly precipitation for water year 1989 compared to mean monthly precipitation, 1958-1989, in four AYK locations.

LITERATURE CITED

Alaska Department of Environmental Conservation (ADEC). 1986. Water quality in Alaska, report 305(b) to the Environmental Protection Agency. Alaska Department Environmental Conservation, Juneau.

Alaska Department of Fish and Game (ADFG). 1978. Alaska's fisheries atlas. Vol. 2 [R. F. McLean and K. J. Delaney, comps.]. 43pp. + 153 maps.

_____. 1983. Emergency order standards of applicability. Alaska Department of Fish and Game, Commissioner's office. Juneau, Alaska. 18pp.

_____. 1984. Sport Fish Survey. Booklet published by Alaska Department of Fish and Game, Division of Sport Fisheries. Juneau, Alaska.

_____. 1986. Alaska Habitat Management Guide, Arctic Region. Vol. II: Distribution, abundance, and human use of fish and wildlife. Div. of Habitat, Alaska Department of Fish and Game, Juneau, AK.

Alaska Department of Labor (ADL). 1987. Alaska Population Overview 1985 Estimates. Demographic Unit, Research and Analysis. Juneau, Alaska.

Alaska Department Natural Resources (ADNR). 1988. Kuskokwim Area Plan. Juneau, Alaska.

Alt, K. T. 1978. Inventory and cataloging of sport fish and sport fish waters of western Alaska. Alaska Department of Fish and Game, Federal Aid in Fish Restoration. Annual Report of Progress. 1977-1978, Project F-9-10, 19(G-I-P): 36-76.

_____. 1981. A life history study of sheefish and whitefish in Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual report of progress, 1980-1981. Project F-9-13, 22(RII): 28 pp.

_____. 1984. Inventory and cataloging of sport fish and sport fish waters of western Alaska. Part B: Fisheries resource investigations and sheefish adaptability studies. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual performance report, 1983-1984. Project F-9-16, 25(G-I-P-B).

_____. 1987. Review of Sheefish (*Stenodus leucicthys*) studies in Alaska. Alaska Department of Fish and Game. Fishery Manuscript No. 2. Juneau, Alaska. 69 pp.

Alaska National Interest Lands Conservation Act (ANILCA). 1980. Act of Congress. Public Law 96-487, December 2, 1980.

Arvey, W.D. and A.Burkholder. 1990. Stock assessment of northern pike in the vicinity of the Yukon River Haul Road crossing, 1988 and 1989. Alaska Department of Fish and Game. Fishery Manuscript No. 90-1. 38 pp.

Arvey, W.D. 1990. Opinions and regulatory preferences of northwest Alaska anglers. Alaska Department of Fish and Game. Fishery Data Series No. 90-18. 52 pp.

Arvey, W.D., M.F. Merritt, M.J. Kramer, and J.E. Hallberg. 1990. Annual management report for sport fisheries in the Arctic Yukon and Kuskokwim Region, 1986. Alaska Department of Fish and Game. Fishery Management Report No. 90-1. 105 pp.

Arvey, W.D., M.J. Kramer, J.E. Hallberg, J.F. Parker, and A.L. Decicco. 1991. Annual management report for sport fisheries in the Arctic Yukon and Kuskokwim Region, 1987 (in prep.). Alaska Department of Fish and Game. Fishery Management Report.

Arvey, W.D., and J.F. Parker. 1991 Annual management report for sport fisheries in the Arctic Yukon and Kuskokwim Region, 1988 (in prep.). Alaska Department of Fish and Game. Fishery Management Report.

Baxter, R. 1977. Hoholitna River reconnaissance survey, 1977. Kuskokwim Resource Report #3. Arctic Yukon and Kuskokwim Region, Commercial Fisheries Division, Alaska Department of Fish and Game, Anchorage.

Behnke, R. J. 1980. A systematic review of the genus Salvelinus. In Charrs: salmonid fishes of the genus Salvelinus, E.K. Balon, ed. Dr. W. Junk publishers, The Hague.

Bendock, T. N.. 1980. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual performance report, 1979-1980. Project F-9-12, 21(G-I-I).

_____. 1982. Inventory and cataloging of arctic waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual performance report, 1981-1982. Project F-9-14, 23(G-I-I).

_____. 1983. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual performance report, 1982-1983. Project F-9-15, 20(G-I-I).

Bendock, T. N. and Burr, J. M. 1984. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual performance report, 1983-1984. Project F-9-16, 25(G-I-I).

Bendock, T.N. and J.M. Burr. 1985. Unpubl. Freshwater fish distributions in the central arctic coastal plain (Topagoruk River to Ikpikpuk River). Alaska Department of Fish and Game, Division of Sport Fish, Fairbanks.

Bergstom, D., S. Merkouris, K. Schultz, and R. Holder. 1989. Salmon stocks and fisheries in the Yukon Area, Alaska, 1989. A report to the Alaska Board of Fisheries. Regional Informational Report No. 3A89-29. ADFG, Anchorage, AK. 28 pp.

Bernard, D. R. and A. L. DeCicco. 1987. Stock assessment of the Dolly Varden char of Kotzebue Sound. Alaska Department of Fish and Game. Fisheries Data Series No. 19. Juneau, Alaska. 28 pp.

Bue, F. 1990. Personal communication. Alaska Department of Fish and Game. Division of Commercial Fisheries, Nome, AK.

Bundtzen, T., R.C. Swainbank, J. Deagen and J.L. Moore. 1990. Alaska's Mineral Industry, 1989. Special Report 44. Department of Natural Resources (DNR), Division of Geology and Geophysical Surveys, Juneau, Alaska. 100 pp.

Burkholder, A. 1990. Stock composition of northern pike in Minto Flats during 1989. Alaska Department of Fish and Game. Fisheries Data Series No. 90-25. 25 pp.

Burr, J. M. 1987. Synopsis and bibliography of lake trout, *Salvelinus namaycush* in Alaska. Alaska Department of Fish and Game. Fishery Manuscript No. 5. Juneau, Alaska. 50 pp.

Burr, J.M. 1990. Stock assessment and biological characteristics of lake trout populations in interior Alaska, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-33. 50 pp.

Clark, R. A. 1987. Arctic grayling harvests, stock status, and regulatory concerns in the Arctic Yukon Kuskokwim region. A report to the Alaska Board of Fisheries, December, 1987. Alaska Department of Fish and Game, 1300 College Rd. Fairbanks, Alaska, 99701.

Clark, R.A. 1990a. Stock assessment of Arctic grayling in Fielding Lake. Alaska Department of Fish and Game. Fishery Data Series No. 90-1. 29 pp.

Clark, R.A. 1990b. Stock status of Chena River Arctic grayling. Alaska Department of Fish and Game. Fishery Data Series No. 90-4. 52 pp.

Clark, R.A. and W.P. Ridder. 1990. Stock assessment of Arctic grayling in the Salcha, Chatanika, and Goodpaster Rivers. Alaska Department of Fish and Game. Fishery Data Series No. 90-7. 84 pp.

DeCicco, A.L. 1985. Inventory and cataloging of sport fish and sport fish waters of western Alaska with emphasis on Arctic char life history sutdies. Alaska Department of Fish and Game Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985. Project F-9-17, Job G-I-P-A. Volume 26 pp 41-134.

Decicco, A.L. 1990. Seward Peninsula Arctic grayling study 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-11. 30 pp.

Decicco, A.L. 1990. Northwest Alaska Dolly Varden study 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-8. 42 pp.

Doxey, M. 1987. Tanana drainage lake stocking evaluations, 1986. Alaska Department of Fish and Game. Fishery Data Series No. 31. Juneau, Alaska. 32 pp.

Doxey, M. 1989. Evaluation of stocked waters in the Tanana drainage, 1988. Alaska Department of Fish and Game. Fishery Data Series No. 106. 49pp.

Evenson, M.J. 1990. Movement, abundance, and length composition of burbot in rivers of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-3. 26pp.

Francisco, R. K., K. Schultz, D. Schneiderhan, and D. Huttunen. 1987. Annual Management Report Kuskokwim Area 1985-1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bethel. Unpublished agency report.

Francisco, R. K., C. Burkey Jr., D.B. Molyneaux, C. Anderson, H. H. Hamner, D. Schneiderhan, M.W. Coffing, R.J. Walker and K.E. Hyer 1990. Annual Management Report Kuskokwim Area 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3B90-25. Bethel, AK. Unpublished report. 212 pp.

Furniss, R. A. 1974. Inventory and cataloging of arctic area waters. Alaska Department of Fish and Game Federal Aid in Fish Restoration, Annual performance report, 1973-1974. Project F-9-6, 15(G-I-I).

Gallaway, B., W. Gazey and L. Moulton. 1987. Population trends for arctic cisco in the Colville River of Alaska as reflected by the commercial fishery. Biological Papers, University of Alaska, Fairbanks.

Green, C., T. Bundtzen, R. Peterson, and A. Seward. 1989. Alaska's Mineral Industry, 1988. Special Report 43. Department of Natural Resources (DNR), Division of Geology and Geophysical Surveys, Fairbanks, Alaska. 79 pp.

Guinn, D.A. and J.E. Hallberg. 1990. Precision of estimated ages of burbot using vertebrae and otoliths. Alaska Department of Fish and Game. Fishery Data Series No. 90-17. 17 pp.

Hallberg, J. E. 1984. Evaluation of Interior Alaska waters and sport fish with emphasis on managed waters- Fairbanks District. Alaska Department of Fish and Game Federal Aid in Fish Restoration, Annual performance report, 1983-1984. Project F-9-16, 25(G-III-H).

Hallberg, J. E. and R. A. Holmes. 1987. Abundance and size composition of Chatanika River least cisco and humpback whitefish with estimates of exploitation by recreational spear fishermen. Alaska Department of Fish and Game. Fishery Data Series No. 25. Juneau, Alaska. 26 pp.

Hemming, C. 1988. Aquatic habitat evaluation of flooded North Slope gravel mine sites (1986-1987). Alaska Department of Fish and Game, Division of Habitat. Technical Report No. 88-1. Juneau 69 pp.

Hemming, C.R. 1990. Fisheries investigations of flooded North Slope gravel mine sites, 1989. Alaska Department of Fish and Game, Division of Habitat. Technical Report No. 90-2. 38 pp.

Holder, R. 1991. Personal communication. Alaska Department of Fish and Game, Division of Commercial Fisheries, Fairbanks.

Holmes, R., D.N. McBride, T. Viavant, and J.B. Reynolds. 1990. electrofishing induced mortality and injury to rainbow trout, arctic grayling, humpback whitefish, least cisco, and northern pike. Alaska Department of Fish and Game. Fishery Manuscript No. 90-3. 95 pp.

Holmes, R. and Pearse, G. 1987. Northern Pike stock status and regulatory concerns in the Arctic Yukon Kuskokwim Region. A report to the Alaska Board of Fisheries, December, 1987. Alaska Department of Fish and Game, 1300 College Rd., Fairbanks, Alaska, 99701.

Kretsinger, C. 1987. Fishery inventory of lakes and streams in the Kigluaik mountains and Imuruk Basin watershed (Seward Peninsula). Unpublished paper, U.S. Bureau of Land Management. Kobuk District Office, Fairbanks.

Lafferty, R., J.F. Parker, and D.R. Bernard. 1990. Stock assessment and bilogical characteristics of burbot in lakes of interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-48.

Lamke, R.D., J.L. Van Maanen, B.B. Bigelow, P.J. Still and R.T. Kemnitz. 1990. Water Resources Data Alaska Water Year 1989. U.S. Geological Survey Water-Data Report AK-89-1. 224 pp.

Lean, C. 1985. Unpubl. Agency rept. Unalakleet River escapement studies, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries. Nome, Alaska.

Lean, C., S. Merkouris, H. Hamner, and M. Wyatt. 1986. Unpubl. Agency report. Annual Management Report, 1986, Norton Sound-Port Clarence-Kotzebue. Alaska Department Fish and Game, Division of Commercial Fisheries. Nome, Alaska.

Merkouris, S.E. and C.F. Lean. 1989. Unpubl. Agency report. Annual Management Report , 1988 Norton Sound-Port Clarence-Kotzebue. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region. Regional Information Report No. 3N89-10. 187 pp.

Merritt, M.F., A.E. Bingham, and N. Morton. 1990. Creel surveys conducted in interior Alaska during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-54. 125 pp.

Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1977-1978. Project F-9-11, 20 (SW-1): 112 pp.

_____. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1979-1980. Project F-9-12, 21 (SW-1): 65 pp.

_____. 1981. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1980-1981. Project F-9-13, 22 (SW-1): 78 pp.

_____. 1982. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1981-1982. Project F-9-13, 23 (SW-1): 115 pp.

_____. 1983. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1982-1983. Project F-9-14, 24 (SW-1): 118 pp.

_____. 1984. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1983-1984. Project F-9-16, 25 (SW-1): 122 pp.

_____. 1985. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1984-1985. Project F-9-17, 26 (SW-1): 88 pp.

_____. 1986. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1985-1986. Project F-9-18, 27 (SW-1): 137 pp.

_____. 1987. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1986-1987. Project F-9-19, 28 (SW-1): 91 pp.

_____. 1988. Alaska statewide sport fisheries harvest report 1987. Alaska Department of Fish and Game. Fishery Data Series No. 52. 95 pp.

_____. 1989. Alaska statewide sport fisheries harvest report 1988. Alaska Department of Fish and Game. Fishery Data Series No. 122. 142 pp.

_____. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-44. 152 pp.

Morrow, J. E. 1980. Analysis of the Dolly Varden charr, *Salvelinus malma*, of northwestern North America and northeastern Siberia. In Charrs. Salmonid Fishes of the genus Salvelinus. ed. by Balon, E.K. Publ. by Dr. W. Junk, the Netherlands. pp 323-338.

Moulton, L., B.J. Gallaway, M.H. Fawcett, W.B. Griffiths, K.R. Critchlow, R.G. Fechhelm, D.R. Schmidt, and J.S. Baker. 1986. 1984 central Beaufort Sea fish study. Prudhoe Bay waterflood project. Environmental monitoring program. Vol. 2, Chapt. 3. LGL, Woodward-Clyde consultants and U.S. Army Corps of Engineers, Anchorage, Alaska. 204 pp

National Oceanic Atmospheric Administration (NOAA). 1989. Local climatological data for Fairbanks, Nome, Kotzebue and Barrow, Alaska. Annual summary for 1988 and 1989. Fairbanks, Alaska.

National Park Service (NPS). 1984. Kobuk Valley National Park draft statement for management. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1985a. Gates of the Arctic National Park General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1985b. Cape Krusenstern Monument General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1985c. Yukon Charley Rivers National Preserve General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1986a. Kobuk National Park General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1986b. Noatak National Preserve General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

_____. 1986c. Bering Land Bridge National Preserve General Management Plan. USDI: NPS, Alaska Regional Office, Anchorage, Alaska.

Parker, J.F., R. Lafferty, W.D. Potterville and D.R. Bernard. 1989. Stock assessment and biological characteristics of burbot in lakes of interior Alaska during 1988. Alaska Department of Fish and Game. Fishery Data Series No. 98. 86pp.

Pearse, G.A. 1990. Abundance and age, sex, and length composition of the northern pike populations of George, Volkmar, and T Lakes, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-42. 36 pp.

Peckham, R.D., and M. Doxey. 1983. Evaluation of Interior Alaska waters and sport fish with emphasis on managed waters- Delta District. Alaska Department of Fish and Game. Federal Aid in Fisheries Restoration, Annual report of progress 1982-1983. Project F-9-15, 24(G-III-I). 38 pp.

Redick, R. R. 1967. A review of literature on lake trout life history with notes on Alaska management. Alaska Department of Fish and Game, Informational Leaflet 111. 19 pp.

Ridder, W.P. 1990. Stock assessment of Arctic grayling in the Tangle Lakes and River system 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-15. 55 pp.

Rue, S., N. Hemming and M. McGuiness. 1987. A method of evaluating the recreation potential of Alaskan rivers. Submitted under contract to the National Park Service, Alaska Regional Office by the Wildlife Federation of Alaska, the Alaska affiliate of the National Wildlife Federation. 118 pp.

Russell, R. 1980. A fisheries inventory of waters in the Lake Clark Monument area. Alaska Department of Fish and Game, Division of Sport Fish, and United States Department of the Interior, National Park Service.

Savikko, H., and T. Page 1990. 1989 preliminary Alaska commercial fisheries harvest and values. Regional Informational Report No. 5J90-07. Alaska Department of Fish and Game, Juneau, AK. 102 pp.

Selkregg, L. L. 1976. Alaska regional profiles: Arctic region. Arctic Environmental Information and Data Center, University of Alaska, Anchorage.

Skaugstad, C. 1990a. Effects of fin removal on survival and growth of Arctic char in a hatchery environment. Alaska Department of Fish and Game. Fishery Data Series No. 90-28. 11 pp.

Skaugstad, C. 1990b. Abundance, egg production, and age-sex-size composition of the chinook salmon escapement in the Chena River, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-13. 32 pp.

Skaugstad, C. 1990c. Abundance, egg production, and age-sex-size composition of the chinook salmon escapement in the Salcha River, 1989. Alaska Department of Fish and Game. Fishery Data Series No. 90-23. 32 pp.

Stokes, J. 1985. Natural resource utilization of four upper Kuskokwim communities. Technical Paper No. 86. Alaska Department of Fish and Game, Division of Subsistence.

Timmons, S.L. 1990. Abuncance and length, age, and sex composition of Chatanika River humpback whitefish and least cisco. Alaska Department of Fish and Game. Fishery Data Series No. 90-2. 40 pp.

U.S. Army Corps of Engineers, Alaska District. 1967. Harbors and Rivers in Alaska. Interim Report No. 6. Northwestern Alaska.

U.S. Department of Interior/Bureau of Land Management Alaska Fire Service. 1989. 1989 fire season statistics. Intelligence section. FCC Fort Wainwright Alaska. 27 pp.

U.S. Department of Agriculture (USDA). 1989. Alaska snow surveys, May 1, 1989. Soil Conservation Service, Anchorage, Alaska. 31 pp.

U.S. Fish and Wildlife Service (USFWS). 1982. Arctic National Wildlife Refuge coastal plain resource assessment. Initial report baseline study of the fish, wildlife, and their habitats. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503. 507 pp.

_____. 1985. Yukon Flats National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1986. Selawik National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1987a. Yukon Delta National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1987b. Nowitna National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1987c. Koyukuk and Innoko National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1987d. Kanuti National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

_____. 1988. Arctic National Wildlife Refuge Plan. USDI: USFWS, Region 7. 1011 E. Tudor Rd., Anchorage, Alaska 99503.

Viavant, T.R. and J.H. Clark. 1990. Opinions and regulatory preferences of anglers resident in urban ind rural portions of the Tanana drainage in 1988. Alaska Department of Fish and Game. Fishery Data Series No. 90-19. 128 pp.

Weber, P.K. 1986. Downstream effects of placer mining in the Birch Creek Basin, Alaska. Alaska Department of Fish and Game, Habitat Division. Technical Report no. 86-7. 21 pp.

Wild and Scenic Rivers Act 1968. U.S. Public Law 90-542. Amended December, 1980 with Public Law 96-603-605.

Whitmore, C., D. J. Bergstrom, and F. M. Andersen. 1987. Annual Management Report, 1987, Yukon Area. Regional Information Report No. 3A88-30. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage and Fairbanks. 167 pp.

Whitmore, C., D. J. Bergstrom, F. M. Andersen, G. Sandone, J. Wilcock, L. Barton and D. Messiar. 1990. Annual Management Report, Yukon Area, 1988. Regional Information Report No. 3A90-28. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage and Fairbanks. In press.

Winters, J.F. 1990. A transplant of Arctic grayling to a flooded gravel mine site in the Kuparuk River oilfield. Alaska Department of Fish and Game, Habitat Division. Juneau AK. Technical Report No. 90-4. 25 pp.

APPENDIX A

Appendix A. National Wild and Scenic Rivers in the Arctic Yukon Kuskokwim Region.

River	Federal Unit or Area
Alatna	Gates of the Arctic National Park
John	Gates of the Arctic National Park
Kobuk	Gates of the Arctic National Park
Upper Noatak	Gates of the Arctic National Park
North Fork of the Koyukuk	Gates of the Arctic National Park
Tinayguk	Gates of the Arctic National Park
Salmon	Kobuk Valley National Park
Charley	Yukon-Charley Preserve
Upper Selawik	Selawik National Wildlife Refuge
Andreafsky and East Fork	Yukon Delta National Wildlife Refuge
Nowitna (a 357 km section)	Nowitna National Wildlife Refuge
Ivishak	Arctic National Wildlife Refuge
Upper Sheenjek	Arctic National Wildlife Refuge
Wind	Arctic National Wildlife Refuge
Upper Unalakleet	Norton Sound
Upper Beaver Creek	Interior Alaska
Birch Creek	Interior Alaska
Delta	Interior Alaska
Fortymile	Interior Alaska

APPENDIX B

Emergency orders issued in 1989 for the AYK Region.

Appendix B. Emergency orders issued in 1989 for the AYK Region.

SPORT FISHING
Emergency Order

ALASKA DEPARTMENT OF FISH AND GAME

Under Authority of AS 16.05.060

Emergency Order No., 3-AC/DV-2-89 Issued at Fairbanks, July 20, 1989

Effective Date 12:01 a.m.
Thursday, July 21, 1989

Expiration date 11:59 p.m.
Sunday, December 31, 1989
unless superseded by subsequent
emergency order.

EXPLANATION:

This emergency order closes the Kongakut River on the Arctic Slope to the taking of Arctic char/Dolly Varden trout from 12:01 a.m., Thursday, July 21, 1989 until 11:59 p.m., Monday, December 31, 1989.

REGULATION:

5 AAC 70.020 is amended to read:

(q) The Kongakut River is closed to the taking of Arctic char and/or Dolly Varden trout.

Don W. Collinsworth
Commissioner

By delegation to: _____
William D. Arvey
Area Management Biologist

JUSTIFICATION:

Normally char are present in Kongakut River during the early summer months. Reports from anglers have indicated a virtual absence of char in the stream at this time, when normally they would be abundant.

Aerial surveys conducted by Alaska Department of Fish and Game staff on 16 June and 2 July verified an absence of large char in the river. Consequently, for the purpose of stock conservation, the river is closed to the taking of char. Any char caught incidentally while fishing for other species must be returned to the water immediately.

DISTRIBUTION:

The distribution list is on file in the Department of Fish and Game office in Fairbanks.

SPORT FISHING
Emergency Order

ALASKA DEPARTMENT OF FISH AND GAME

Under Authority of AS 16.05.060

Emergency Order No. 3-AC/DV-1-89 Issued at Fairbanks, July 14, 1989

Effective Date 12:01 a.m. Monday, July 17, 1989

Expiration date 11:59 p.m. Sunday, December 31, 1989 unless superseded by subsequent emergency order.

EXPLANATION:

This emergency order closes the Kongakut River on the Arctic Slope to the retention of Arctic char/Dolly Varden trout from 12:01 a.m., Monday, July 17, 1989 until 11:59 p.m., Monday, December 31, 1989.

REGULATION:

5 AAC 70.020 is amended to read:

(q) In the Kongakut River only catch and release sport fishing on Arctic char and/or Dolly Varden trout is allowed .

Don W. Collinsworth
Commissioner

By delegation to: _____
William D. Arvey
Area Management Biologist

JUSTIFICATION:

Normally char are present in Kongakut River during the early summer months. Reports from anglers have indicated a virtual absence of char in the stream at this time, when normally they would be abundant.

Aerial surveys conducted by Alaska Department of Fish and Game staff on 16 June and 2 July verified an absence of large char in the river. Consequently, for the purpose of stock conservation, the river is closed to the retention of char, and all fish taken must be released immediately.

DISTRIBUTION:

Copies are available from Department of Fish and Game Offices in Fairbanks.

Emergency Order No. 3-AC/DV-1-89 Issued at Fairbanks, July 14, 1989

Effective Date 12:01 a.m.
Monday, July 17, 1989

Expiration date 11:59 p.m.
Sunday, December 31, 1989
unless superseded by subsequent
emergency order.

EXPLANATION:

This emergency order closes the Kongakut River on the Arctic Slope to the retention of Arctic char/Dolly Varden trout from 12:01 a.m., Monday, July 17, 1989 until 11:59 p.m., Monday, December 31, 1989.

REGULATION:

5 AAC 70.020 is amended to read:

(q) In the Kongakut River only catch and release sport fishing on Arctic char and/or Dolly Varden trout is allowed .

Don W. Collinsworth
Commissioner

By delegation to: _____
William D. Arvey
Area Management Biologist

JUSTIFICATION:

Normally char are present in Kongakut River during the early summer months. Reports from anglers have indicated a virtual absence of char in the stream at this time, when normally they would be abundant.

Aerial surveys conducted by Alaska Department of Fish and Game staff on 16 June and 2 July verified an absence of large char in the river. Consequently, for the purpose of stock conservation, the river is closed to the retention of char, and all fish taken must be released immediately.

DISTRIBUTION:

Copies are available from Department of Fish and Game Offices in Fairbanks.

APPENDIX C

AYK Region sport fishing regulations summary for 1989.

Appendix C. AYK Region sport fishing regulations summary for 1989.

ARCTIC—YUKON—KUSKOKWIM AREA

This is a summary of the official regulations codified in 5 AAC 70.001-050 which are available for inspection at libraries, department offices, and Department of Public Safety offices throughout the state.

INSTRUCTIONS:

1. Find the water (alphabetically listed) that you intend to fish. If the water, or any portion of it, is not listed, the regulations in the shaded entry apply.
2. Use the Code Key to determine open season, catch, and length limits. Read Special Regulations.
3. An asterisk(*) denotes Special Regulations apply.

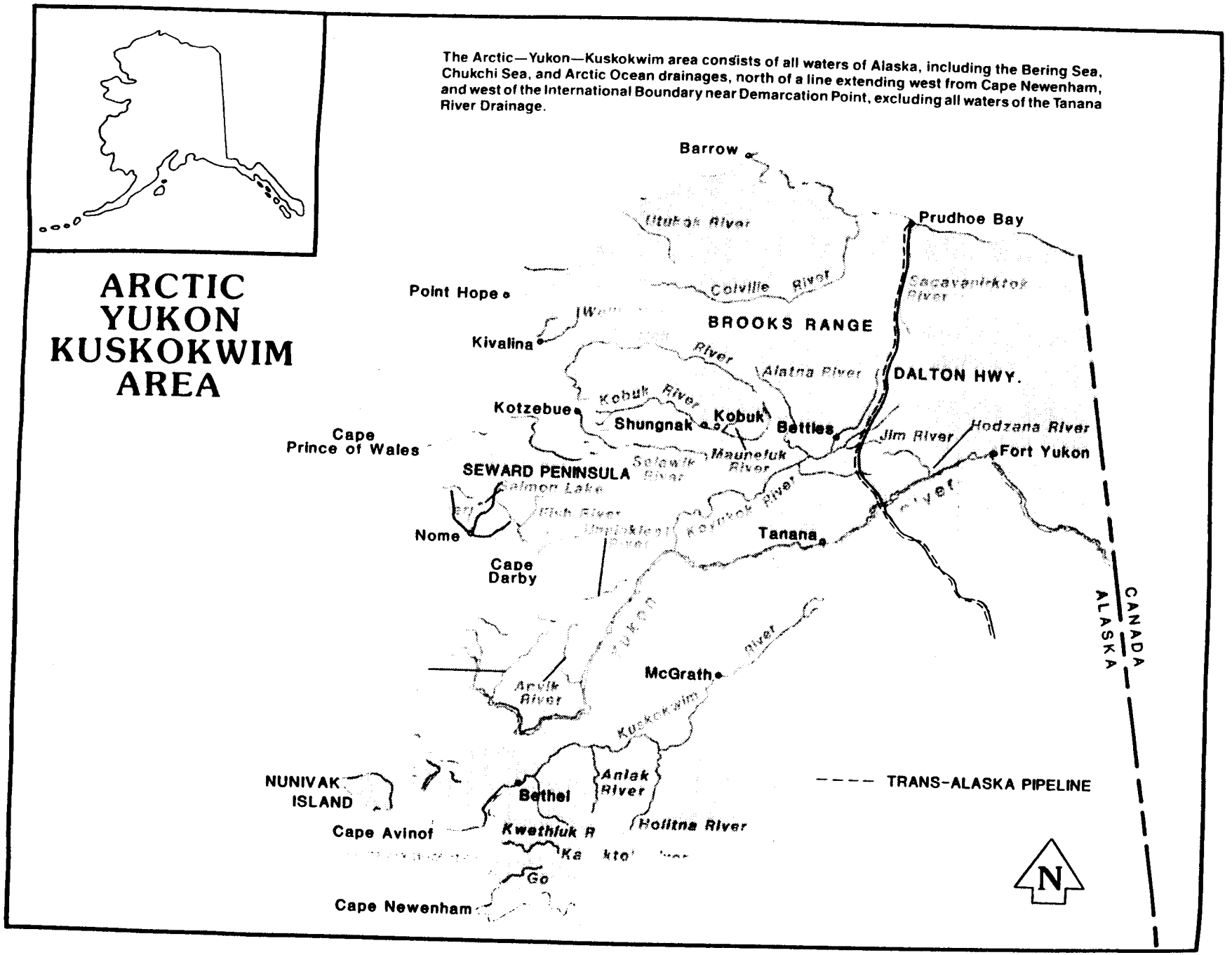
WATER AND SPECIAL REGULATIONS	SEASON AND CATCH LIMIT					
	SALMON	DOLLY VARDEN/ ARCTIC CHAR/ LAKE TROUT/ RAINBOW/ GRAYLING	SHEEFISH	NORTHERN PIKE/ BURBOT	HALIBUT	OTHER FISH
All waters not listed below	A,C	F,G,J,I	L	N,P	Q	R
Kivalina River drainage:	C	G,K,I	L	N,P		R
Kobuk River drainage:						
upstream of the mouth of Mauneluk River	C	G,J,I	M	N,P		R
remainder of the Kobuk River	C	G,J,I	L	N,P		R
Kuskokwim Bay drainages: All waters that drain into Kuskokwim Bay (excluding the Kuskokwim River) from Cape Avinof to Cape Newenham	A,E	F,G,J,I	L	N,P	Q	R
Special Regulations: No person may sport fish from a boat or the river bank within 300 feet of a legally operating subsistence set gillnet on the Goodnews or Kanektok River downstream of the Togiak National Wildlife Refuge wilderness area boundary.						
Kuskokwim River drainage:	B,E	F,G,J,I	L	N,P		R
Noatak River drainage:	C	G,K,I	L	N,P		R
Seward Peninsula waters: (All waters draining into the Bering Sea from Cape Darby to Cape Prince of Wales on the Seward Peninsula)	B*,D*	H,J		N,P		R
Special Regulations: *Salmon Lake, its tributaries, and the outlet stream 300 feet downstream from the lake outlet are closed to salmon fishing.						
Trans-Alaska Pipeline (A corridor 5 miles wide on each side of the alignment.)	Closed	G,J,I	L	N,P		R
Unalakleet River drainage:	B,C	H,J		N,P		R
Wulik River drainage:	C	G,K,I	L	N,P		R
Yukon River drainage:						
from the mouth of the Tanana River upstream to, and including, the Hodzana River	A,C	G,J,I	L	O,P		R
remainder of the drainage	A,C	G,J,I	L	N,P		R

OTHER ARCTIC—YUKON—KUSKOKWIM AREA REGULATIONS

METHODS AND MEANS. 1. In all lakes, multiple hooks with gap between point and shank greater than one-half inch may be used for taking fish other than salmon.

2. Sucker and Burbot, may be taken by spear or bow and arrow from January 1 through December 31.

3. Northern Pike and Whitefish (excluding sheefish) may be taken by spear or bow and arrow from September 1 through April 30 and may be speared by persons completely submerged from January 1 through December 31.


ARCTIC
YUKON
KUSKOKWIM
AREA
The Arctic—Yukon—Kuskokwim area consists of all waters of Alaska, including the Bering Sea, Chukchi Sea, and Arctic Ocean drainages, north of a line extending west from Cape Newenham, and west of the International Boundary near Demarcation Point, excluding all waters of the Tanana River Drainage.
Barrow
Prudhoe Bay
Point Hope
Kivalina
BROOKS RANGE
DALTON HWY.
Kotzebue
Shungnak
Kobuk
Bettles
Cape
Prince of Wales
SEWARD PENINSULA
Fort Yukon
Nome
Tanana
Cape
Darby
McGrath
CANADA
ALASKA
NUNIVAK
ISLAND
Bethel
Cape Avinof
Cape Newenham
TRANS-ALASKA PIPELINE
N

ARCTIC-YUKON-KUSKOKWIM AREA

CODE KEY: ARCTIC-YUKON-KUSKOKWIM AREA Use these codes to determine open season, catch and length limits.

CODE		OPEN SEASON	BAG, POSSESSION, AND SIZE LIMITS
A	KING SALMON	Entire Year	3 per day, 3 in possession, only 2 can exceed 28 inches
B	KING SALMON	Entire Year	1 per day, 1 in possession, no size limit
C	OTHER SALMON	Entire Year	10 per day, 10 in possession, no size limit
D	OTHER SALMON	Entire Year	10 per day, 10 in possession, only 3 which may be chum salmon and coho salmon, in combination
E	OTHER SALMON	Entire Year	5 per day, 5 in possession, no size limit
F	RAINBOW TROUT	Entire Year	2 per day, 2 in possession, no size limit
G	GRAYLING	Entire Year	10 per day, 10 in possession, no size limit
H	GRAYLING	Entire Year	5 per day, 5 in possession, only 1 over 15 inches
I	LAKE TROUT	Entire Year	4 per day, 4 in possession, no size limit
J	ARCTIC CHAR/DOLLY VARDEN	Entire Year	10 per day, 10 in possession, no size limit
K	ARCTIC CHAR/DOLLY VARDEN	Entire Year	10 per day, 10 in possession, only 2 over 20 inches
L	SHEEFISH	Entire Year	10 per day, 10 in possession, no size limit
M	SHEEFISH	Entire Year	2 per day, 2 in possession, no size limit
N	NORTHERN PIKE	Entire Year	10 per day, 10 in possession, no size limit
O	NORTHERN PIKE	Entire Year	5 per day, 5 in possession, only 1 over 30 inches
P	BURBOT	Entire Year	15 per day, 15 in possession, no size limit
Q	HALIBUT	Feb. 1—Dec. 31	2 per day, 4 in possession, no size limit
R	OTHER FISH	Entire Year	No bag, possession or size limit

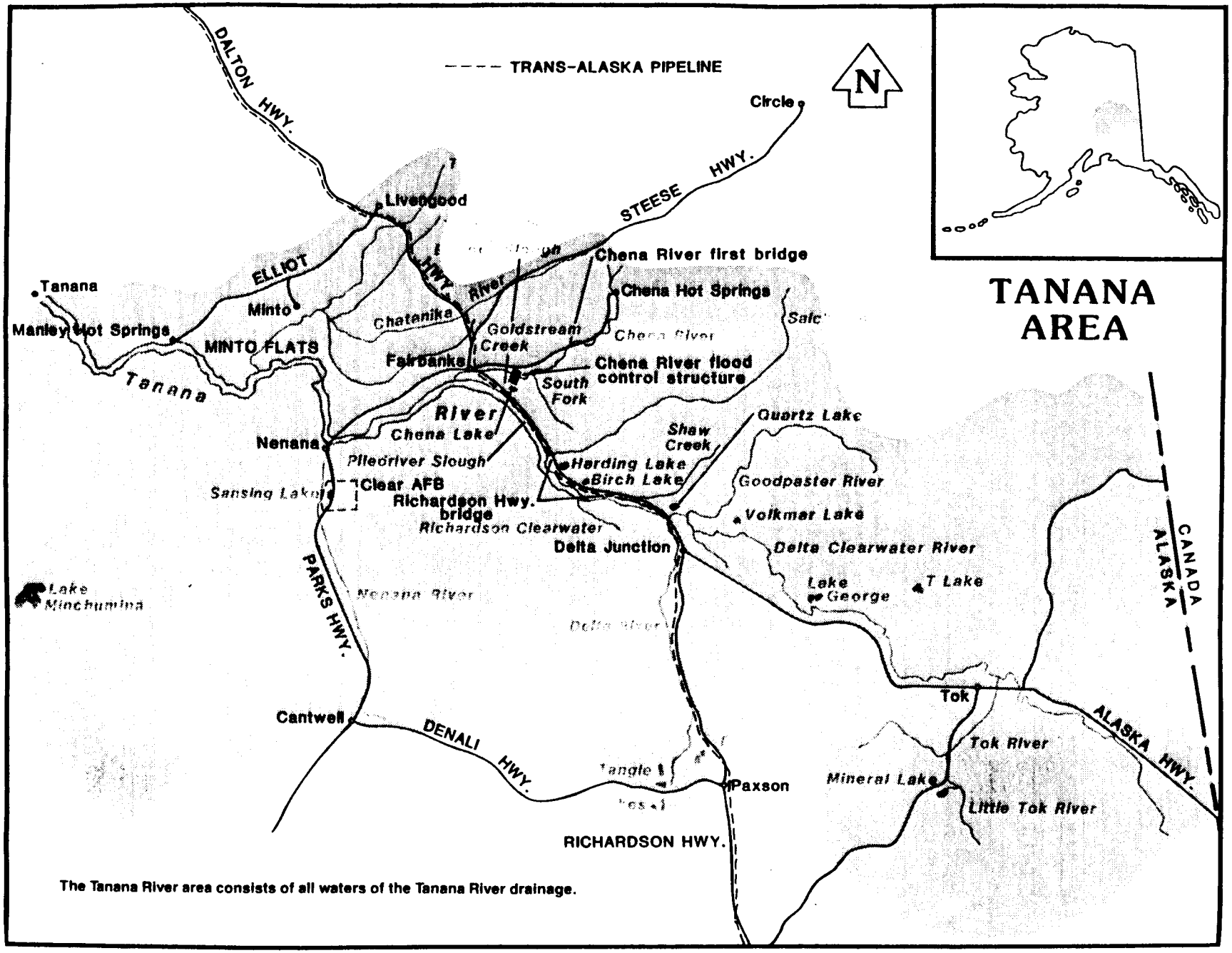
TANANA AREA

This is a summary of the official regulations codified in 5 AAC 70.001-060 (as they apply to waters of the Tanana River Drainage) which are available for inspection at libraries, department offices, and Department of Public Safety offices throughout the state.

INSTRUCTIONS:

1. Find the water (alphabetically listed) that you intend to fish. If the water, or any portion of it, is not listed, the regulations in the shaded entry apply.
2. Use the Code Key to determine open season, catch, and length limits. Read Special Regulations.
3. An asterisk(*) denotes Special Regulations apply.

WATER AND SPECIAL REGULATIONS	SEASON AND CATCH LIMIT				
	SALMON	DOLLY VARDEN/ ARCTIC CHAR/ LAKE TROUT/ RAINBOW/ GRAYLING	WHITEFISH/ SHEEFISH	NORTHERN PIKE/ BURBOT	OTHER FISH
All waters not listed below	A,B	C,D,F,I,L	M,N	O,Q,R	T
Chena River and its tributaries:					
downstream from a department marker 300 feet downstream from the Chena River flood control structure	A,B	H*	M,N	O,R	T
remainder of drainage	Closed	H*	M,N	O,R	T
Special Regulations: (Unless otherwise specified, each special regulation applies to the entire Chena River and its tributaries)					
1. Upstream of the Chena River Dam, only unbaited, artificial lures or flies may be used.					
2. Downstream of the Chena River Dam, bait may be used only on hooks with a gap size larger than ¾ inch.					
3. *Grayling may not be possessed or retained from April 1 to the first Saturday in June; all grayling caught between these dates must be released immediately.					
4. The Chena River from the confluence of the South Fork (river mile 77) to the first bridge (river mile 88) is designated a catch and release water for grayling. Grayling may not be possessed or retained. All grayling caught must be released immediately.					


TRANS-ALASKA PIPELINE
N
TANANA AREA
DALTON HWY.
Circle
STEESE HWY.
Livengood
ELLIOT HWY.
Chena River first bridge
Tanana
Minto
Chena Hot Springs
Manley Hot Springs
MINTO FLATS
Chatanika River
Goldstream Creek
Fairbanks
Chena River flood control structure
South Fork
Tanana River
Nenana
Chena Lake
Pledriver Slough
Quartz Lake
Shaw Creek
Harding Lake
Birch Lake
Goodpaster River
Clear AFB
Richardson Hwy. bridge
Richardson Clearwater
Volkmar Lake
Delta Junction
Delta Clearwater River
PARKS HWY.
Lake Minchumina
Lake George
T Lake
CANADA
ALASKA
Tok
Cantwell
DENALI HWY.
Tok River
ALASKA HWY.
Mineral Lake
Paxson
Little Tok River
RICHARDSON HWY.
The Tanana River area consists of all waters of the Tanana River drainage.

TANANA AREA WATER AND SPECIAL REGULATIONS	SEASON AND CATCH LIMIT SALMON	DOLLY VARDEN/ ARCTIC CHAR/ LAKE TROUT/ RAINBOW/ GRAYLING	WHITEFISH/ SHEEFISH	NORTHERN PIKE/ BURBOT	OTHER FISH
Delta Clearwater River and its tributaries: **Special Regulations:** 1. Only unbaited artificial lures or flies may be used. 2. *Grayling may not be possessed or retained from April 1 to the first Saturday in June; all grayling caught between these dates must be released immediately.	B	H*	M,N	O,R	T
Fielding Lake **Special Regulations:** *No set lines may be used.		F,J	N	S*	T
Goodpaster River drainage:	Closed	F	M,N	O,R	T
Harding Lake **Special Regulations:** *No set lines may be used.	A,B	C,F,J,L	M,N	O,S*	T
Mineral Lake Outlet (From the outlet of Mineral Lake to its confluence with the Little Tok River) **Special Regulations:** 1. Only unbaited artificial lures or flies may be used. 2. *Grayling may not be possessed or retained from April 1 to the first Saturday in June; all grayling caught between these dates must be released immediately.		H*	M,N	O,R	T
Pilediver Slough upstream from its confluence with Moose Creek: **Special Regulations:** Only unbaited artificial lures or flies may be used.	B	D,G	M,N	O,R	T
Richardson Clearwater River drainage: **Special Regulations:** 1. Only unbaited artificial lures or flies may be used. 2. *Grayling may not be possessed or retained from April 1 to the first Saturday in June; all grayling caught between these dates must be released immediately.	B	H*	M,N	O,R	T
Salcha River and its tributaries: downstream from a marker placed approximately 2½ miles upstream from the Richardson Hwy. Bridge: upstream from a marker placed approximately 2½ miles upstream from the Richardson Hwy. Bridge: **Special Regulations:** 1. Only unbaited artificial lures or flies may be used. 2. *Grayling may not be possessed or retained from April 1 to the first Saturday in June; all grayling caught between these dates must be released immediately. 3. Fishing from the Richardson Hwy. Bridge over the Salcha River is prohibited.	A,B Closed	H* H*	M,N M,N	O,R O,R	T T
Sansing Lake	A,B	E,F			
Shaw Creek and its tributaries: **Special Regulations:** 1. Only unbaited artificial lures or flies may be used upstream of the Richardson Hwy. Bridge. 2. Downstream of the Richardson Hwy. Bridge, bait may be used only on hooks with a gap size larger than ¾ inch. 3. *Grayling may not be possessed or retained from April 1 to the first Saturday in June in Shaw Creek drainage and the Tanana River from 2 miles upstream of the mouth of Shaw Creek to 2 miles downstream of the mouth of Shaw Creek; all grayling caught between these dates must be released immediately.	B	H*	M,N	O,R	T
"T" Lake **Special Regulations:** *No set lines may be used.			N	O,S*	T
Tangle Lakes **Special Regulations:** *No set lines may be used.		F,K	N	S*	T
Tolovana River drainage (Includes Minto Flats, Chatanika River, Tatalina River, and Goldstream Creek:	A,B	F	M,N	P,R	T

CODE KEY: TANANA AREA Use these codes to determine open season, catch and length limits.

CODE		OPEN SEASON	BAG, POSSESSION, AND SIZE LIMITS
A	KING SALMON		
	16 inches or more	Entire Year	1 per day, 1 in possession
	Less than 16 inches	Entire Year	10 per day, 10 in possession
B	OTHER SALMON		
	16 inches or more	Entire Year	3 per day, 3 in possession
	Less than 16 inches	Entire Year	10 per day, 10 in possession

C	RAINBOW TROUT (In Lakes) 20 inches or more Less than 20 inches	 Entire Year Entire Year	 2 per day, 2 in possession 10 per day, 10 in possession
D	RAINBOW TROUT (Flowing waters)	Entire Year	5 per day, 5 in possession, no size limit
E	RAINBOW TROUT	Entire Year	3 per day, no size limit
F	GRAYLING	Entire Year	5 per day, 5 in possession, no size limit
G	GRAYLING	Entire Year	5 per day, 5 in possession, 12 inch minimum length limit
H	GRAYLING	First Saturday in June through March 31	5 per day, 5 in possession, 12 inch minimum length limit
I	LAKE TROUT	Entire Year	2 per day, 2 in possession, no size limit
J	LAKE TROUT	Entire Year	2 per day, 2 in possession, 18 inch minimum length limit
K	LAKE TROUT	Entire Year	1 per day, 1 in possession, 18 inch minimum length limit
L	ARCTIC CHAR/DOLLY VARDEN	Entire Year	10 per day, 10 in possession, no size limit
M	SHEEFISH	Entire Year	2 per day, 2 in possession, no size limit
N	WHITEFISH (Excluding Sheefish)	Entire Year	15 per day, 15 in possession, no size limit
O	NORTHERN PIKE	Entire Year	5 per day, 5 in possession, only 1 over 30 inches
P	NORTHERN PIKE	June 1 through October 14	5 per day, 5 in possession, only 1 over 30 inches
Q	BURBOT (In Lakes)	Entire Year	5 per day, 5 in possession, no size limit
R	BURBOT (Flowing Waters)	Entire Year	15 per day, 15 in possession, no size limit
S	BURBOT	Entire Year	2 per day, 2 in possession, no size limit
T	OTHER FISH	Entire Year	No bag, possession or size limit

OTHER TANANA AREA REGULATIONS

METHODS AND MEANS. (1) In all lakes, multiple hooks with gap between point and shank greater than one-half inch may be used for taking fish other than salmon.

(2) Suckers and burbot may be taken by spear or bow and arrow from January 1 through December 31.

(3) Northern pike and whitefish (excluding sheefish) may be taken by spear or bow and arrow from September 1 through April 30 and may be speared by persons completely submerged from January 1 through December 31.

(4) Burbot may be taken by set lines in all lakes in the Tanana River drainage (except for Fielding, Harding, "T", and Tangle Lakes) from October 15 through May 15.

(5) Burbot may be taken by set lines in rivers year round.

(6) The total aggregate number of hooks used on set lines, closely attended gear, and ice fishing gear may not exceed the daily bag limit for burbot in the water being fished.

(7) All ice houses not removed from the ice at the end of the day's fishing must be registered and a permit secured from the Department. Each registered ice house must have permit numbers displayed on its side and roof in distinguishable numbers not less than 12 inches in height.

APPENDIX D

Appendix D. Partial listing of wilderness lodges, guiding, and outfitting operations in the AYK Region.

Location	Operation	Remarks
Seward Peninsula/Norton Sound:		
White Mtn.	Fishing lodge, guiding	Opened in 1986
Niukluk, Fish R.	Outfitters	
Unalakleet R.	1 lodge	
Kuskokwim:		
Tonzona R.	2 lodges	Includes hunting
Holitna R.	2 lodges, 6 guides	Includes hunting
Hoholitna R.	1 lodge	
Aniak R.	6 guides, misc. outfitters	
Arctic:		
Kobuk R.	a few small lodges (20 guests)[a]	
Walker Lk.	1 lodge	
Alatna R.	1 lodge	

[a] NPS encourages nonconsumptive use of Kobuk Valley Park, so these loeges may offer more for the sightseer than the angler.